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Diamond Chuitna Coal Project
Final Environmental Impact Statement. Volume 1

(U.S.) Environmental Protection Agency, Seattle, WA

Feb 90

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Region 10
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Diamond Chuitna Coal Project

Final Environmental Impact Statement

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REPLY TO
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To All Interested Government Agencies, Public Officials, Public Groups, and Citizens

Pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969 and implementing Federal Regulations, the U.S. Environmental Protection Agency (EPA) has prepared this Final Environmental Impact Statement (FEIS) for the proposed Diamond Chuitna Coal Project. The project sponsor, Diamond Alaska Coal Company, proposes to develop a twelve million ton per year coal mine in the Beluga region of upper Cook Inlet, approximately 45 miles west of Anchorage, Alaska. The project would consist of an open pit mine and associated coal transportation and port facilities, service facilities, and housing accommodations.

Diamond Alaska Coal Company, in association with Granite Point Coal Port, Inc., and Tidewater Services Corporation, has applied to EPA for National Pollutant Discharge Elimination System (NPDES) permits to discharge pollutants from the mine, port, and housing facilities to navigable waters pursuant to the Clean Water Act. These facilities have been determined to be New Sources under Section 306 of the Clean Water Act and, according to Section 511(c)(1) of the Clean Water Act, are subject to the provisions of the National Environmental Policy Act. The draft NPDES permits were released for public review concurrently with the Draft Environmental Impact Statement (DEIS). Public comments on the draft NPDES permits have been considered, and the proposed final NPDES permits are included in this FEIS (Appendix D).

The U.S. Department of the Army, Corps of Engineers (Corps), and the State of Alaska Department of Natural Resources (DNR) are cooperating agencies for the environmental impact statement. The Corps, under the authority of Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act, will evaluate proposed project-related activities in waters of the United States. Appendix C of this FEIS contains a complete description of the proposed activities requiring Corps authorization. The DNR is authorized to review, pursuant to the Alaska Surface Coal Mining Control and Reclamation Act (AS27.21, 11 AAC Ch. 90), Diamond Alaska Coal Company's detailed application for a permit to conduct surface mining. This permit application was the subject of a separate state review and approval process, which was completed on August 21, 1987.

EPA will announce the availability of this document in the Federal Register on the date indicated below, initiating a 30-day review period. Address all comments to:

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Federal Register Notice of
Availability of FEIS: February 2, 1990

Deadline for comments on FEIS: March 5, 1990

FINAL

ENVIRONMENTAL IMPACT STATEMENT

DIAMOND CHUITNA COAL PROJECT

Prepared By

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10

Cooperating Agencies

U.S. Department of the Army
Corps of Engineers

Alaska Department of Natural Resources

With Technical Assistance From

Dames & Moore

RESPONSIBLE OFFICIAL:

Robie G. Russell
Regional Administrator
Environmental Protection Agency
Region 10
Date: December 1, 1989

COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)
DIAMOND CHUITNA COAL PROJECT
SOUTHCENTRAL ALASKA

Lead Agency:	U.S. Environmental Protection Agency (EPA)
Responsible Official:	Robie G. Russell Regional Administrator Environmental Protection Agency 1200 Sixth Avenue Seattle, Washington 98101
Cooperating Agencies:	U.S. Army Corps of Engineers (Corps) Alaska Department of Natural Resources (DNR)

Abstract of FEIS

The actions to be considered are the approvals of federal permits for the proposed Diamond Chuitna Coal Project located on the west side of Cook Inlet in southcentral Alaska. The project would consist of a surface coal mine, haul road, a method of transporting coal to a port facility on Cook Inlet, dock facilities, and other ancillary facilities. Three action alternatives and a no action alternative are discussed in detail. Rationale for eliminating various options is given. The preferred alternative would include construction of a port site at Ladd, an eastern transportation corridor, development of a housing facility at Lone Creek, and a conveyor system which would parallel the haul road and transport coal to the port site. The impacts of the proposed project are considered in terms of vegetation, fish, wildlife, wetlands, water quality and hydrology (both surface and subsurface), physical and chemical oceanography, air quality, visual resources, cultural resources, subsistence, socioeconomics, recreation, technical feasibility, and future uses of facilities.

Public Review Process

This FEIS is offered for review to members of the public, interested groups, and public agencies. Public hearings were held in August of 1988 in Anchorage, Tyonek, and Soldotna, Alaska, to solicit comments on the Draft Environmental Impact Statement (DEIS), issued July 15, 1988, the draft EPA National Pollutant Discharge Elimination System (NPDES) permits, and the Corps authorized activities. Comments received on the DEIS and permits are addressed in this FEIS. Comments received on this FEIS will be considered in the EPA and Corps Records of Decision for this project.

Location of FEIS or Technical and Reference Reports and Appendices

Copies of this FEIS and/or the major reports relating to the Diamond Chuitna Coal Project EIS are available for review at the following locations:

Seattle

Environmental Protection Agency
Environmental Evaluation Branch
1200 Sixth Avenue, WD-136
Seattle, WA 98101

Anchorage

Dames & Moore
5761 Silverado Way, Bldg. P
Anchorage, AK 99518

Alaska Dept. of Natural Resources
Division of Mining
Eighth Floor
3601 'C' Street (Frontier Bldg.)
P.O. Box 107016
Anchorage, AK 99510

Diamond Alaska Coal Company
1227 West Ninth Ave., Suite 201
Anchorage, AK 99501

Z. J. Loussac Library
3600 Denali St.
Anchorage, AK 99503

Kenai Peninsula Borough

Kenai Peninsula Borough*
Resource Development Dept.
147 N. Binkley
Soldotna, AK 99669

Kenai Community Library**
163 Main Street Loop
Kenai, AK 99611

Tyonek Community Center**
Tyonek, AK 99682

Deadline for comments: March 5, 1990

Address all comments to:

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(206) 442-8510

Additional copies of the FEIS may also be obtained by contacting the EIS Project Officer.

* 27 volume permit application only.

**All reports except permit application.

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Summary

SUMMARY

Purpose of and Need for Action

Diamond Alaska Coal Company (Diamond Alaska) proposes to develop a coal mine in the Beluga region of upper Cook Inlet, Alaska. The project would consist of a surface mine and associated transportation, shipping, and housing facilities. Diamond Alaska is proceeding with applications for the various permits and approvals needed for such a development.

The U.S. Environmental Protection Agency (EPA) has the responsibility for issuing New Source National Pollutant Discharge Elimination System (NPDES) Permits for wastewater discharges from the proposed Diamond Chuitna Coal project. EPA's NPDES regulations [40 CFR 122.29(c)(2)] require that the Environmental Impact Statement (EIS) include a recommendation on whether the NPDES Permit should be issued or denied. They also require that such action shall occur only after a complete evaluation of the projected impacts and recommendations contained in the final EIS (FEIS) [40 CFR 122.29(c)(3)]. EPA recommends the issuance of the NPDES permits for this proposed project with conditions. The conditions are described in the proposed final NPDES permits and fact sheets included in Appendix D of this FEIS.

In addition, the U.S. Department of the Army Corps of Engineers (Corps), Alaska District, has jurisdiction over this action under Section 10 of the River and Harbor Act of 1899 which provides for control over structures or work in or affecting navigable waters of the U.S.; and under Section 404 of the Clean Water Act which provides for regulation of the discharge of dredged or fill material into U.S. waters, including wetlands. The Corps intends to adopt this EIS to fulfill its National Environmental Policy Act (NEPA) obligations if its concerns are satisfied in the document.

Pursuant to NEPA and implementing regulations issued by the Council on Environmental Quality (CEQ), EPA, and the Corps, this EIS has been prepared to evaluate the potential impacts of the proposed actions on the environment and to fulfill the permitting requirements of EPA and the Corps. EPA has the lead responsibility for preparing this document and the Corps is a cooperating agency. The Alaska Department of Natural Resources (DNR) is also a cooperating agency because of its role in implementing the federal Surface Mining Control and Reclamation Act (SMCRA) through the Alaska Surface Coal Mining Program.

Project Description

Full development of the Diamond Chuitna coal project would involve a 10.9 million Mt (12 million short ton) per year surface coal mine in the Beluga area approximately 72 km (45 mi) west of Anchorage. The coal is sub-bituminous, low sulphur, low ash, high moisture steam coal with an average of 4,250 kilocalories per kilogram (7650 BTU per lb). The actual area to be mined during the projected 34-year life of the project would be approximately 2,029 ha (5,014 ac) with a maximum of 182 ha (450 ac) of pit being open at any one time.

Mining methods would employ shovels, draglines, hydraulic backhoes, front-end loaders, and haul trucks. Coal would be initially crushed at the mine and carried to a 22 ha (55 ac) mine service area by conveyor for further crushing and weighing. It would then be transported approximately 17.6 km (11 mi) by a single-span, 1.2 m (48 in) wide conventional conveyor to a port site on Cook Inlet either at Granite Point south of the mine or at Ladd east of the mine.

The entire conveyor structure would be supported by a horizontal steel pipe elevated about 0.6 m (2 ft) above the ground and would be about 2.9 m (9.6 ft) high overall. It would be enclosed on the top and one side except at stream crossings where the underside would also be enclosed. At appropriate locations, the conveyor would be raised or buried to permit human and large mammal passage across the corridor. The conveyor would be paralleled by a light duty maintenance road and an all-weather gravel/access haul road.

The onshore port facilities would occupy approximately 104 ha (260 ac) on the bluff above Cook Inlet at either Granite Point or Ladd. No one would be housed there. Up to 1.1 million Mt (1.2 million short tons) of coal would be stockpiled at the port for shipment. At full production, the offshore port facility would consist of an elevated trestle up to 3,810 m (12,500 ft) long, depending upon the port site, and would support twin conveyors for loading coal ships. At maximum length, the trestle would have a berthing depth of between 15.2 and 18.2 m (50 and 60 ft) and could service ships up to 108,864 Mt (120,000 dwt).

The workforce would be housed in permanent single-status housing and community facilities on an 8 ha (20 ac) site north of the Chuitna River near the mine (Lone Creek site), south of the Chuitna River midway between the mine and Granite Point (Congahbuna site), or northeast of the mine site (Threemile Creek site). The facilities would accommodate a total of 540 people at full production. A new gravel airstrip with a main runway of 1,524 m (5,000 ft) would be constructed adjacent to the housing site.

Average-load electrical power demands would be approximately 35 Mw with a maximum of 50 Mw. Power would be purchased from the existing Chugach Electric Association natural gas generating station at Beluga. Water for all facilities would be supplied by wells.

Construction employment would peak at approximately 1,300 and the permanent work force would total about 848 workers. Half of that total (424) would be at the project site at any one time working two 11-hour shifts per day. Employees would work a four-day-on, four-day-off schedule, and would be flown back to their homes in Anchorage or on the Kenai Peninsula during their off-work periods.

Construction would take approximately three years. Production would begin at a level of about 1.8 million Mt (2 million short tons) and increase to full production capacity as economics permit. The minimum time to full production would be four years from construction completion.

Existing Environment

The project area is largely undeveloped except for a system of primitive roadways that remain as a result of past oil, logging, and coal exploration activities. Most of the project area, including all the Diamond Chuitna coal lease area, is state land as is the Trading Bay State Game Refuge to the south. Most of the land east of the project area is owned or selected by the Tyonek Native Corporation, while Cook Inlet Region, Inc. owns the majority of the remainder of the land on the northeast, north, and west. The Kenai Peninsula Borough has either selected or received selection approval to land at or near both potential port sites.

Most of the project area consists of a broad, gently sloping plateau characterized by irregular ridges and depressions. The southern edge of the plateau terminates at a coastal bluff rising from the gravelly beaches of Cook Inlet. Much of the area is poorly drained with bogs and ponds. Vegetation on the area consists primarily of spruce-birch forest intermixed with open, muskeg terrain.

A major portion of the area provides moderate to high quality habitat for moose, brown bear, and black bear. A portion of a moose rutting concentration area is located within the northern half of the mine site; moose winter in a narrow zone along the coast. Birds occupying the project area include bald eagles, as well as small numbers of trumpeter swans and sandhill cranes.

The Chuitna River, which originates in the Alaska Range and enters Cook Inlet north of the village of Tyonek, bisects the project area and is the major drainage system within the project area. Several major tributaries to the Chuitna River are within or adjacent to the proposed mine area. Ground water originating within shallow aquifers in the mine area contributes significantly to the flow of the area streams. Tyonek and Old Tyonek Creeks are separate systems that drain the southern portion of the project area. Water resources are unpolluted and water quality is high.

Important fish resources in the Chuitna River include rainbow trout, chinook, coho, pink, and chum salmon. The river supports a small but high quality sport fishery and contributes salmon to commercial and subsistence fisheries within Cook Inlet.

Cook Inlet adjacent to the project area is characterized by high tides, strong currents, and high turbidity. Important marine life occupying the coastal area includes belukha whales and all 5 species of eastern Pacific salmon.

Air quality is high within the project area; noise pollution is low.

The closest development to the project area is the village of Tyonek, about 11 miles southeast of the mine area. About 95 percent of the approximately 270 residents of Tyonek are Alaska Natives. The village is accessible only by air or sea as there are no road connections to the more populated areas of southcentral Alaska. Subsistence hunting and fishing are important to the economic, cultural, social, and nutritional well-being of most of the permanent residents within the area.

Scoping

The EIS scoping process identified the following 10 issues of concern for the project:

- Maintain the integrity of the Chuitna River watershed by minimizing impacts to water quality and maintaining proper flows
- Maintain the quality of fish habitats in the Chuitna River system and minimize impacts to resident and anadromous fish
- Minimize disruption of wildlife and wildlife habitats, including important seasonal use areas and migration routes

- Assure successful reclamation of project components
- Minimize impacts to the commercial set net fishery and marine life movements near the port trestle
- Minimize impacts to subsistence resources, including access to those resources, as traditionally used by local residents
- Minimize the social, cultural, and economic impacts on local residents
- Maintain a regional perspective to minimize the cumulative impacts of this and other potential development projects
- Minimize chances of system failure by incorporating technically feasible component siting, design, and mitigation features
- Component siting, design, and mitigation features should be cost effective

Options Screening Process

To address the 10 issues, the scoping process identified 31 options for the 12 project components. A two-step options screening process was conducted to determine reasonable options. In the first step, all options were reviewed to eliminate from further consideration those which were clearly unreasonable or infeasible primarily for environmental or technical reasons. Nine options were eliminated.

In the second step, the remaining options were individually evaluated. Since all the options in the applicant's Proposed Project were environmentally and technically reasonable and feasible, all of those options were retained so that the applicant's Proposed Project would constitute a formal alternative to be analyzed during the analysis of alternatives process. Then, for each component where at least one option other than the applicant's choices remained, options were individually evaluated from the perspective of each resource or technical discipline (e.g., water quality, subsistence, technical feasibility). If it was determined that one of the other options was as good as, or better than, an applicant's option on an overall basis or if it addressed one or more of the 10 scoping issues in a significantly more favorable manner than did the applicant's option, that option was retained for the analysis of alternatives process.

Following the options screening process, the best options for all but two of the project components were relatively easy to identify. However, two components (transportation corridor/port site location and housing site location) had three options each that adequately addressed one or more of the 10 issues. These options were therefore retained and, with the other nine options, were used to form the alternatives (Table 1).

Identification and Description of Alternatives

The identification of action alternatives process was relatively straightforward as only three alternatives (combinations of options) were necessary to address the issues raised by the two components with more than one option remaining (transportation/port site location and housing site location). The applicant wishes to retain two transportation corridor/port site options (southern/Granite Point and northern/Ladd). Two alternatives using these options were identified as the applicant's Proposed Project. The applicants' proposal entails development of only one of these transportation corridors. The haul road and conveyor would both be constructed within the same corridor leading to the associated port site (either Ladd or Granite Point). A third alternative, using the eastern/Ladd option, was also identified. The three action alternatives and the No Action Alternative for the Diamond Chuitna coal project are described below.

Southern/Granite Point Alternative

In addition to the fixed mine and mine service area locations, this alternative would site the overburden stockpile southeast of the mining limit. It includes a conveyor system within the southern transportation corridor to the port site at Granite Point. The coal-loading facility at the port would be an elevated trestle. A single-status housing facility with associated new airstrip would be located at the Lone Creek site. Water would be supplied to all facilities by wells, and power would be purchased from the Chugach Electric Association natural gas power station at Beluga.

Northern/Ladd Alternative

This alternative is the same as the southern/Granite Point alternative except the northern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

Table 1

OPTIONS USED TO FORM ALTERNATIVES

Component[1]	Option(s)
Mine Location	Fixed
Overburden Stockpile Location	Southeast
Mine Service Area	Fixed
Transportation System	
o Corridor Location[2]	Southern/Granite Point Northern/Ladd Eastern/Ladd
o Mode	Conveyor
Loading Facility	Elevated Trestle
Housing	
o Location(2)	Lone Creek Congahbuna Threemile Creek
o Type	Single Status
Airstrip	New
Water Supply	Wells
Power	Purchase

---

(1) One of original 12 components was dropped during option screening process.

(2) Component with more than one option remaining.

Eastern/Ladd Alternative

This alternative would be the same as the northern/Ladd alternative except that the eastern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

No Action Alternative

The No Action Alternative means that development of the Diamond Chuitna project would not occur. This would result from denial of one or more of the federal or state permits necessary for project development or from a decision by the applicant not to undertake the project.

Comparison of Alternatives

The impacts of each of the three action alternatives were compared against the 10 issue criteria identified during the scoping process. Then the impacts of each alternative relative to one another (Table 2) were compared for identification of the preferred alternative. The Congahbuna and Threemile housing/airstrip options were then compared with the Lone Creek option to determine whether either option provided a significant advantage over the Lone Creek site such that it could substitute for the Lone Creek option in one or more of the alternatives.

Identification of Preferred Alternative

The eastern/Ladd alternative, using the Lone Creek housing site, had the least overall relative total impact value and was identified as the preferred alternative. Whether the applicant could develop an eastern corridor, however, is not certain since the corridor would cross private land owned by Tyonek Native Corporation. To date, the applicant has been unable to negotiate a right-of-way across that land.

Environmental Consequences of the Preferred Alternative

Overall environmental consequences of the entire project would be similar regardless of which corridor alternative is developed. At maximum mine extent, project components would disturb about 2,029 ha (5,014 ac) of vegetated terrain. However, because of the ongoing reclamation of mined out areas, the actual unvegetated surface area at any one time in the mine life would be substantially less. About 24 percent of the area to be disturbed is classified as wetland.

TABLE 2

EVALUATION CRITERIA MATRIX SHOWING RELATIVE[*] TOTAL IMPACT VALUES ASSIGNED TO THE THREE ACTION ALTERNATIVES

	Evaluation Criteria	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
1.	Minimize risk of water quality degradation and alteration to flows	Moderate	Moderate	Low
2.	Minimize impacts to fish and fish habitat	Moderate	Moderate	Low
3.	Minimize impacts to wildlife and wildlife habitats	Moderate	High	Low
4.	Minimize potential reclamation problems	Low	Low	Low
5.	Minimize impacts to set net fishery	Moderate	High	High
6.	Minimize impacts to traditional subsistence harvest activities	High	Low	Low
7.	Minimize social, cultural, and economic impact upon local residents	Moderate	Moderate	Low
8.	Minimize cumulative regional use impacts	Low	Moderate	Moderate
9.	Minimize technical complexity	Low	Low	Low
10.	Minimize cost	No Data	No Data	No Data

---

[*] "High", "moderate", and "low" are comparative among the three corridor options, not absolute values of potential environmental impacts.

Wildlife impacts would include loss of habitat during the mine life and for a period thereafter. Moose, brown bear, and black bear would be affected, as well as small mammals and birds. Loss of moose winter range at the proposed port site and a portion of a rutting area in the mine vicinity would be among the more important impacts. Movement of large mammals would be partially impeded by the conveyor system, although the presence of wildlife crossing areas would assure access across the transportation corridor. Reclamation of disturbed terrain would return wildlife values in the long term to near the premining condition.

Water quality and hydrology of Chuitna River tributaries within and adjacent to the mine site would be significantly altered during mine operation, for a period thereafter, and possibly over the long term depending on postmining hydrological characteristics and on the success of stream reclamation. Impacts would include increased suspended solids concentrations, higher turbidity, and reduced flow in some stream segments. A substantial portion of one tributary would be mined through causing direct habitat loss.

Loss of fish productivity, including such key species as chinook and coho salmon, would occur during mine operation and for a period thereafter. It is questionable whether mined-through streams could be returned to premining productivity; therefore, fish productivity loss could be a long term impact. Loss in productivity would have a small adverse impact on the Chuitna River sport fishery and a very small effect on commercial and subsistence fisheries in the marine environment.

Air quality would be degraded only locally with no significant impact to populated areas.

Socioeconomic impacts to the Anchorage and Kenai Peninsula population centers would be minor or insignificant. Tyonek residents would receive both beneficial and adverse impacts from the project. Increased employment opportunities and village income would be potential benefits while the increased development and human intrusion into the area would likely cause disruption to traditional Native lifestyles and loss of subsistence hunting and fishing opportunities.

Chapter 1.0

Purpose of and Need for Action

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

1.1.1 The EIS Process

The National Environmental Policy Act (NEPA) of 1969 requires the preparation of an Environmental Impact Statement (EIS) whenever a proposed major federal action could significantly affect the quality of the human environment. Large development projects, such as the Diamond Chuitna Coal Project, normally require permits from one or more federal agencies. The issuance of these permits can be considered a major federal action if the range of anticipated impacts is of sufficient magnitude to potentially create significant effects. The agency or agencies involved make a determination regarding significant impacts and can elect to prepare the EIS if needed. The agency can either prepare the EIS itself or contract the preparation of all or part of the document (under the agency's supervision).

The NEPA regulations which outline the purpose, requirements, and procedures for the EIS process may be found in the Code of Federal Regulations at 40 CFR Parts 1500 to 1508. NEPA regulations also require that the EIS address, to the fullest extent possible, state and local planning requirements in addition to the federal permitting actions. An EIS provides an information base which assists state and local agencies in addressing their permitting and other regulatory actions.

The primary purpose of the EIS process is to ensure that environmental information is available to public officials and citizens before permit decisions are made and before actions are taken. The process must encourage and facilitate public involvement in the decisions affecting the quality of the human environment.

"Scoping" is the first step of the EIS process. The purpose of the scoping process is to provide an opportunity for members of the public, interest groups, and agencies to assist in defining the significant environmental issues related to the proposed project. Once these specific issues are identified, they are described in a document called the Responsiveness Summary that is distributed to all interested agencies and parties. These issues form the primary basis for determining the range of alternatives considered in the EIS.

Following scoping, the lead agency or agencies must ensure that sufficient environmental information is available to adequately address the significant issues raised during the scoping process. Alternative means of achieving the proposed project's objectives are developed and the environmental impacts are studied and compared. Finally, the EIS document is prepared and distributed to the public in draft form (DEIS) for a minimum of 45 days for formal review. During this period, public hearings or meetings are held to discuss the DEIS and to receive comments. Submission of written comments is also encouraged.

Comments are evaluated following public review and the DEIS is changed accordingly. All written comments received during the review period are either reproduced in the final EIS (FEIS) or summarized (depending on the number of comments) and the points raised are individually addressed in that document. The FEIS is then distributed for another public review period raised are individually addressed in that document. The FEIS is then distributed for another public review period of at least 30 days before any decisions about the project can be implemented. This is to allow for additional public comments on the FEIS.

Once a permit decision has been made, a formal public record of decision is prepared by each permitting federal agency. The Record of Decision (ROD) states what major permit decision was made, identifies all alternatives considered (including those considered environmentally preferable), and may discuss preference among alternatives based on factors such as economic, technical, national policy and agency mission considerations. The ROD also states what means to avoid or minimize environmental harm were adopted and the rationale.

1.1.2 EIS Document Structure

The basic format for an EIS is prescribed by the NEPA regulations. Each section has a specific purpose and often is required to include certain kinds of information. Following is a brief description of the major sections of this EIS.

- Summary - A summary of the EIS stressing major conclusions, areas of controversy, and the issues to be resolved is presented in this section.
- Purpose of and Need for Action - This chapter (1.0) specifies the underlying purpose of the action for which the EIS is being written and why the action is needed.
- The Proposed Project - This chapter (2.0) describes the individual components of the project as proposed by the applicant and the specific options being considered for each component. It tells how the project will be developed and describes the mitigation plan included in the project proposal for all project components.

- Alternatives Including the Proposed Action - Chapter 3.0 is the heart of the EIS. It describes all the initial options that were considered for the project, why many of them were eliminated, and how the final options and alternatives (set of options comprising a total project) were selected. Then, based on the information and analyses presented in the chapters that follow (Affected Environment and Environmental Consequences), the chapter presents the environmental impacts of the proposed project alternatives in comparative form, sharply defining the issues and providing a clear bases for choice by the decision-makers and the public. It also identifies and describes the preferred alternative.

- Affected Environment - Chapter 4.0 succinctly describes the existing environment of the area which would be affected by development of the project. It explains that environment as it currently exists before project development begins.

- Environmental Consequences - This chapter (5.0) forms the scientific and analytic basis for the comparison of alternatives in Chapter 3.0. It details the potential environmental impacts which could be expected for each alternative. In addition, it describes unavoidable impacts, discusses any irreversible or irretrievable commitments of resources, and describes the relationship between short- and long-term productivity.

- Mitigation, Reclamation and Monitoring - Chapter 6.0 summarizes the detailed mitigation and reclamation requirements imposed by the State of Alaska through the Alaska Surface Coal Mining Program and the other state permitting programs; requirements of federal and local permitting programs; and other measures which could be considered by the permitting agencies.

- Consultation and Coordination - This chapter (7.0) describes the process for soliciting input from agencies and the public and how the process is coordinated with the agencies' permitting processes.

- Public Response to the DEIS - Chapter 10.0 includes a response to comments received during the DEIS review, both at public hearings and written comments. Responses indicate how the final document was changed or why no changes were made.

- Appendices - These sections incorporate important supplementary material prepared in connection with the EIS which is more appropriately presented separately from the body of the document.

1.2 DESCRIPTION OF THE PROPOSED ADMINISTRATIVE ACTIONS

This section describes the proposed federal administrative actions that have created the need for this EIS.

Diamond Alaska Coal Company (Diamond Alaska) proposes to develop a 10.9 million Mt (12 million short tons) per year coal mine in the Beluga region of upper Cook Inlet, Alaska. The project would consist of a surface mine and associated transportation, shipping, and housing facilities. Diamond Alaska has initiated the process of applying for the various permits and approvals needed for such a development.

The U.S. Environmental Protection Agency (EPA) has been considering the issuance of New Source National Pollutant Discharge Elimination System (NPDES) Permits for wastewater discharges from the proposed Diamond Chuitna Coal Project. In addition, the U.S. Department of the Army Corps of Engineers (Corps), Alaska District, has jurisdiction over this action under Section 10 of the River and Harbor Act of 1899 which provides for control over structures or work in or affecting navigable waters of the U.S.; and under Section 404 of the Clean Water Act which provides for regulation of the discharge of dredged or fill material into U.S. waters, including wetlands. Action by the Corps could result in denial of the permit, issuance of the permit, or issuance of the permit with stipulations. The Corps intends to adopt this EIS to fulfill its NEPA obligations if its concerns are satisfied in the document.

EPA's NPDES regulations [40 CFR 122.29(c)(2)] require that the EIS include a recommendation on whether the NPDES Permit should be issued or denied. They also require that such action shall occur only after a complete evaluation of the projected impacts and recommendations contained in the final EIS (FEIS)[40 CFR 122.29(c)(3)]. EPA recommends the issuance of NPDES permits with conditions for this proposed final NPDES permits and fact sheets included in Appendix D of this FEIS.

Pursuant to NEPA and implementing regulations issued by the council on Environmental Quality (CEQ), EPA, and the Corps, this EIS has been prepared to evaluate the potential impacts of the proposed actions on the environment and to fulfill the permitting requirements of EPA and the Corps. EPA has the lead responsibility for preparing this document and the Corps is a cooperating agency. The Alaska Department of Natural Resources is also a cooperating agency because of its role in implementing the federal Surface Mining Control and Reclamation Act through the Alaska Surface Coal Mining Program (see Section 1.5).

1.3 PROJECT LOCATION, HISTORY, AND STATUS

The proposed project would be located on the northwest side of upper Cook Inlet, approximately 72 km (45 mi) west of Anchorage and 12.8 km (8 mi) west of the Native community of Tyonek (Figure 1-1). The area is bounded by the Beluga River on the north, the Alaska Range on the west, the flats of Trading Bay State Game Refuge on the southwest, and Cook Inlet on the south and east.

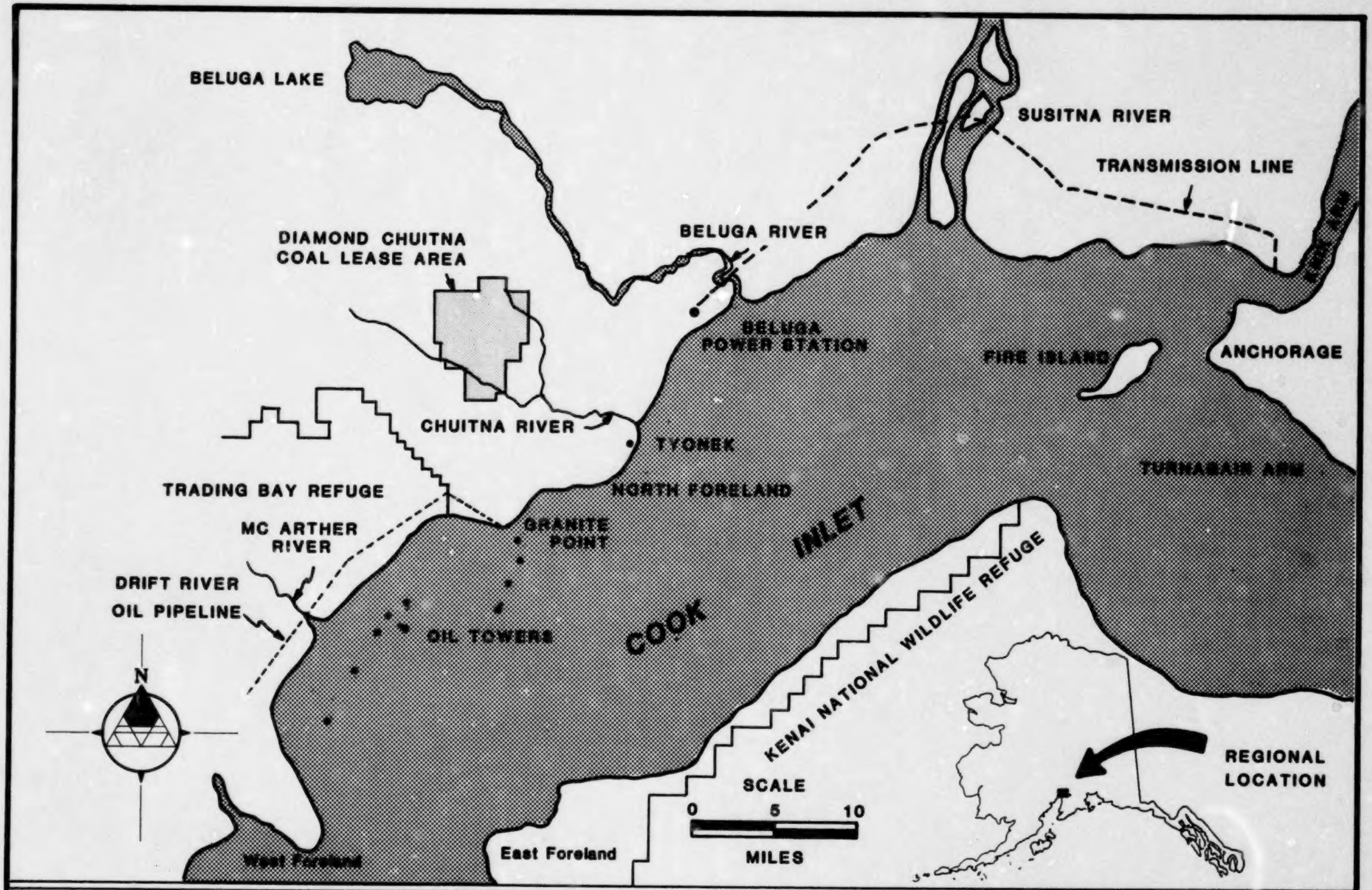
The mine would be situated north of the Chuitna River at an elevation of approximately 229 m (750 ft) and would be 19.2 km (12 mi) from tidewater at Granite Point (Figure 1-2). Topography of the project area consists of gently undulating hills and ridges at the mine site interspread with small streams, ponds, and muskegs, becoming flatter south of the Chuitna River as elevation slowly decreases toward Granite Point. Mixed coniferous and deciduous forests and woodlands extend over most of the project area.

The presence of coal outcrops in the Beluga region of upper Cook Inlet has been known for decades. The area containing these outcrops was selected soon after statehood by the State of Alaska under the federal government's mental health land grant entitlement. The five coal leases affected by the proposed project were issued by the State to the Bass, Hunt, Wilson Group between 1972 and 1978. Coal leases in the area have also been issued to other companies.

Throughout the 1970's, further exploration occurred on the leases, including core drilling to define the reserves. In 1981, the Diamond Shamrock Chuitna Coal Joint Venture was formed to develop the project. The venture partners are Maxus Energy Corporation, a large integrated natural resources company, and the Lone Creek Coal Company. The operating arm of the joint venture is Diamond Alaska Coal Company of Anchorage, a subsidiary of Maxus Energy Corporation. The joint venture holds sublease agreements to the five leases (ADL nos. 36911, 36913, 36914, 37002, and 59502) which constitute the entire lease area.

Diamond Alaska has overseen an intensified drilling program and the completion of many engineering and economic studies, which included a detailed Preliminary Design Phase study. Environmental baseline studies were begun in 1982 and largely completed in 1984. Limited preconstruction monitoring has also begun.

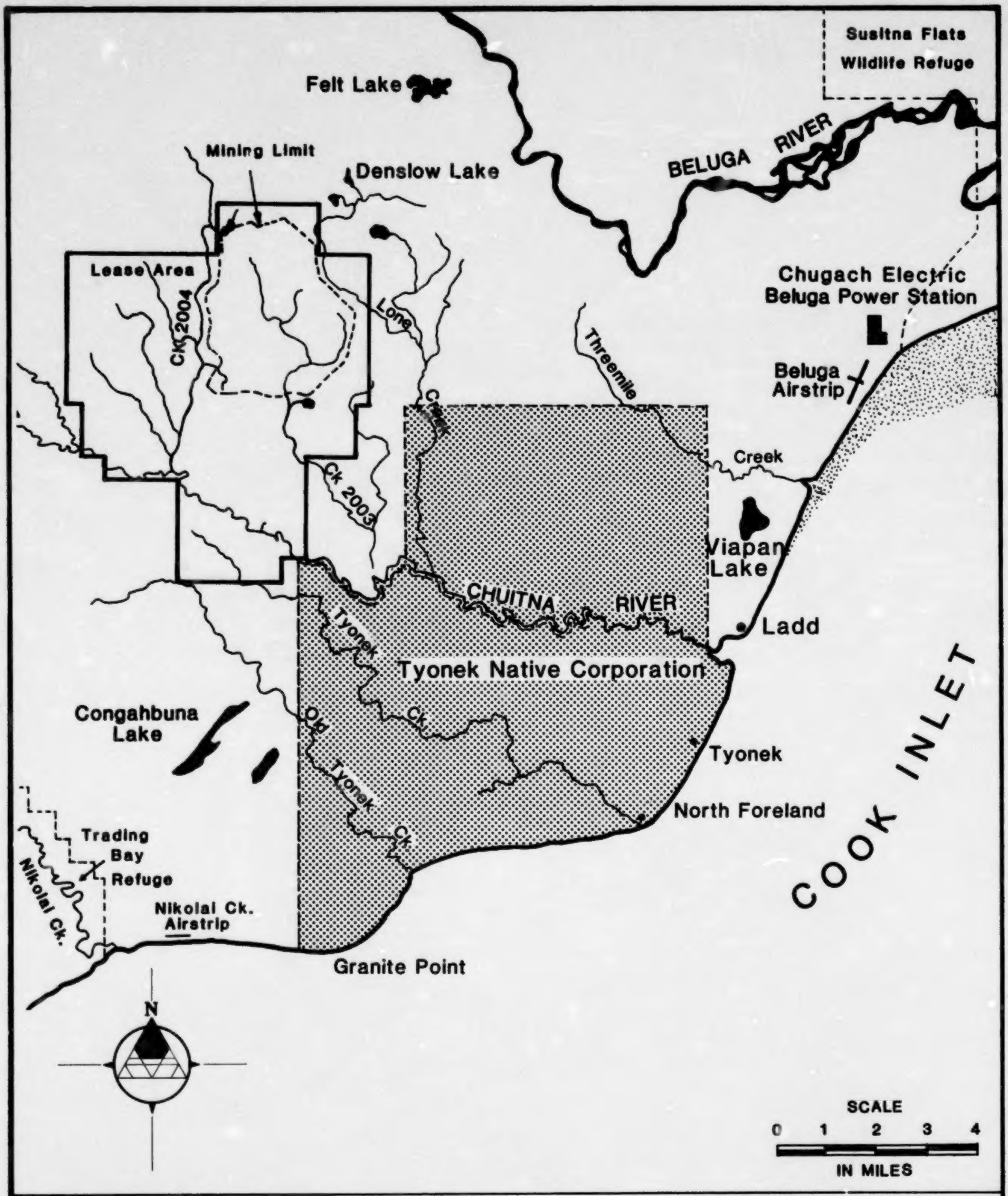
The coal is sub-bituminous, low sulphur, low ash, high moisture steam coal with an average of 4,250 kilocalories per kilogram (7,650 BTU per pound). Diamond Alaska has been marketing the coal to electric utilities, cement, and industrial users in the Pacific states of the United States and to Pacific rim countries, primarily Japan, Taiwan, and Korea.


BELUGA LAKE
SUSITNA RIVER
TRANSMISSION LINE
KNIK ARM
DIAMOND CHUITNA
COAL LEASE AREA
BELUGA RIVER
BELUGA
POWER STATION
FIRE ISLAND
ANCHORAGE
CHUITNA RIVER
TYONEK
TURNAGAIN ARM
TRADING BAY REFUGE
NORTH FORELAND
MC ARTHER
RIVER
GRANITE
POINT
INLET
DRIFT RIVER
OIL PIPELINE
COOK
OIL TOWERS
KENAI NATIONAL WILDLIFE REFUGE
N
REGIONAL
LOCATION
SCALE
0
5
10
MILES
West Foreland
East Foreland

DIAMOND CHUITNA PROJECT LOCATION

Diamond Chuitna Environmental
Impact Statement

FIGURE 1-1



Susitna Flats
Wildlife Refuge
Felt Lake
BELUGA RIVER
Mining Limit
Denslow Lake
Lease Area
Ck 2004
Long
Creek
Chugach Electric
Beluga Power Station
Threemile
Beluga
Airstrip
Creek
Ck 2003
Viapan
Lake
CHUITNA RIVER
Tyonek
Ladd
Tyonek Native Corporation
Ck
Congahbuna
Lake
Old
Tyonek
Ck
Tyonek
North Foreland
COOK INLET
Trading
Bay
Refuge
Nikolai Ck.
Nikolai Ck.
Airstrip
Granite Point
N
SCALE
0 1 2 3 4
IN MILES

DIAMOND CHUITNA PROJECT AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 1-2

1.4 SCOPING ISSUES

During the scoping process, which involved the full participation of Diamond Alaska, members of the public, special interest groups, and agencies involved in the EIS process, the following 10 issues were identified as being of major concern if the project is developed:

Issue 1: Maintain the integrity of the Chuitna River watershed by minimizing impacts to water quality and maintaining proper flows

The proposed project has the potential to alter the characteristics of the Chuitna River watershed in a number of ways:

- Direct disturbance of stream courses in mined areas
- Interruption or diversion of groundwater regimes which could alter input to surface drainages
- Diversion of surface water flow from one subbasin to another
- Degradation of water quality as a result of sediment load from disturbed areas, chemical leaching from coal or overburden, or pollution from sanitary facilities

Issue 2: Maintain the quality of fish habitats in the Chuitna River system and minimize impacts to resident and anadromous fish

Fish habitats could be affected by direct disturbance of stream courses, reduced flows, or water quality degradation.

Issue 3: Minimize disruption of wildlife and wildlife habitats, including important seasonal use and migration areas

The proposed project has the potential to alter the nature and productivity of wildlife habitats and to impede the movements of wildlife.

Issue 4: Assure successful reclamation of project components

The surface mine and other components of the proposed project would temporarily disturb substantial areas of vegetated terrain and existing stream courses. Returning these disturbed areas to a biologically productive condition is a significant concern.

Issue 5: Minimize impacts to the commercial set net fishery human user and marine life movements near the port trestle

The existence of port facilities would have the potential to impede various coastal activities engaged in by humans and to alter the movement of fish and marine mammals.

Issue 6: Minimize impacts to subsistence resources, including access to those resources, as traditionally used by local residents

Hunting, fishing, and trapping activities required by local residents for their subsistence could be affected by either reduced numbers of fish and wildlife in existing use areas or by restricted access to traditional use areas.

Issue 7: Minimize the social, cultural, and economic impacts on local residents

Development of the proposed mine and its housing and transportation infrastructure could affect the lifestyles and livelihoods of local residents, particularly residents of Tyonek.

Issue 8: Maintain a regional perspective to minimize the cumulative impacts of this and other potential development projects

Facilities developed for the proposed project could influence the future development of the area and the extent of cumulative impacts. Therefore, a regional perspective for facility planning should be employed to minimize the range of cumulative impacts that could occur.

Issue 9: Minimize chances of system failure by incorporating technically feasible component siting, design, and mitigation features

If components or mitigation measures become too complex or utilize uncertain technology, then an increased risk of failure could result.

Issue 10: Component siting, design, and mitigation features should be cost effective

If project costs exceed reasonable or practical limits, economic feasibility could become an issue.

1.5 STATUS OR PERMITS AND APPROVALS

One of the purposes of the EIS process is to address the environmental and other concerns of federal, state, and local agencies responsible for various regulatory functions associated with ultimate approval of a project. The EIS process recognizes the informational needs of these agencies as they proceed through their permitting processes and seeks to incorporate relevant information to assist these agencies in their permitting decisions. The public hearings, which are an integral part of the EIS process and cover all concerns pertinent to the project, also serve as public participation forums for state and federal permitting processes.

The reader should note, however, that concurrent with the EIS process, the Alaska Department of Natural Resources (DNR) has conducted a thorough review of Diamond Alaska's 27-volume application for a permit to conduct surface mining. This permit process, completed in August 1987, was conducted pursuant to the Alaska Surface Coal Mining Control and Reclamation Act (AS27.21, 11AAC Chapter 90), and Diamond Alaska's proposed 10-year mining plan than this EIS can reasonably accommodate. Through delegated authority, compliance with the state surface mining laws assures compliance with the federal laws governing surface mining under the Surface Mining Control and Reclamation Act. The EIS serves as an overall planning tool that addresses component siting and operations over the 34-year life of the project and beyond. While certain important aspects of the 10-year mining plan are discussed and analyzed in the EIS, the reader is encouraged to contact the DNR at the address shown on page 7-7 for information related to the surface mining permits.

Diamond Alaska is pursuing the full range of other permits and approvals required for their proposed project. Table 1-1 lists the major permits required and their current status. Superimposed on the individual permit application procedures are two more or less separate but interrelated environmental review processes. The first is the NEPA review process of which this EIS is a part. As discussed in Section 1.2, this EIS provides the background and documentation necessary for processing the major federal permits. In addition, the State of Alaska, through a centralized permit review process administered by the Office of Management and Budget (OMB), reviews all the state permits with individual regulatory agencies. Although each agency issues its own permits, permit decisions are coordinated through OMB on any projects which affect the State's coastal zone. OMB makes the final determination of consistency with the Alaska Coastal Management Program.

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Prior to Alaska Coastal Management Program (ACMP)				
Transportation	Right-of-Way Permit and Easement, ADL 200680 (to Granite Point) - joint application with Beluga Coal Company	ADNR (state)	July 12, 1978 Amended April 15, 1982	In adjudication
Port	Land Lease, ADL 66114 (Granite Point uplands) - joint application with Beluga Coal Company	ADNR (state)	October 24, 1974 Amended November 25, 1981	In adjudication
Port	Tide and Submerged Lands Lease, ADL 66115 (Granite Point) - joint application with Beluga Coal Company	ADNR (state)	October 24, 1974 Amended November 25, 1981	In adjudication
Alaska Coastal Management Program (ACMP) - Phase I; includes state permits for the mine, southern corridor and Granite Point port site.		OMB (state)		Consistency Determination, June 29, 1988
	AK860218-26A (Mine) AK860218-27A (Trans/Housing) AK860218-28A (Port)			
Mine	Permit to conduct surface mining, No. 01-85-796	ADNR/DOM	January 15, 1985	August 21, 1987, Positive Decision June 28, 1988, Final Decision
Port	Water Rights, LAS No. 5558 (Granite Point)	ADNR/DLWM	February 7, 1986	Issued Sept. 29, 1988
Housing	Water Rights, LAS No. 5556	ADNR/DLWM	February 7, 1986	Issued Sept. 29, 1988
Mine	Water Rights, LAS No. 5557	ADNR/DLWM	February 7, 1986	Issued Sept. 29, 1988
Housing	Land Lease, ADL 221186 (includes solid water site)	ADNR/DLWM	May 16, 1985	In adjudication
Housing	Solid Waste Disposal Permit, No. 8623-BA003	ADEC	February 7, 1986	Issued Aug. 9, 1988
Transportation	Anadromous Fish Protection Permit, Title 16 (Granite Point, housing, landing strip)	ADF&G	February 7, 1986	Issued July 27, 1988
Mine	Land Lease, ADL 222752 (Permanent Solid Waste Disposal Site)	ADNR/DLWM	February 14, 1986	In adjudication
Mine	Solid Waste Disposal Permit, No. 8623-BA002 (Permanent Site)	ADEC	February 7, 1986	Issued Aug. 9, 1988
Mine	Land Lease, ADL 222753 (Temporary Solid Waste Disposal Site)	ADNR/DLWM	February 14, 1986	In adjudication

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS
(continued)

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Mine	Solid Waste Disposal Permit, No. 8623-BA001 (Temporary Site)	ADEC	February 7, 1986	Issued Aug. 9, 1988
Transportation/ Housing	Land Lease, ADL 221187 (Landing Strip)	ADNR/DLWM	May 16, 1985	In adjudication
Mine	Rights-of-Way (5 separate approvals for vegetation analysis plots)	ADNR/DLWM	May 16, 1985	Review in Progress
Mine	Anadromous Fish Protection Permit, Title 16	ADF&G	February 7, 1986	Issued July 27, 1988
Transportation	Material Sites, ADL 221188 through 221190 (3 sites)(Granite Point)	ADNR/DLWM	May 16, 1985	Review in Progress
Alaska Coastal Management Program (ACMP) - Phase II; includes NEPA Process, federal approvals and state permits for Ladd		OMB (state)	June 9, 1988	Review in Progress
Mine	National Pollutant Discharge Elimination System (NPDES)(19 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Port (Granite Point)	National Pollutant Discharge Elimination System (NPDES)(2 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Housing	National Pollutant Discharge Elimination System (NPDES)(3 discharges)	U.S. EPA	July 26, 1985 Amend	Under review - pending completion of the NEPA process
Port (Ladd)	National Pollutant Discharge Elimination System (NPDES)(1 discharge)	U.S. EPA	January 1987	Under review - pending completion of the NEPA process
Mine, Housing, Transportaton and both Ports	Department of the Army Permit (Sections 10 & 404)	COE	June 5, 1987 Revised	Under review - pending completion of the NEPA process
Mine, Housing, and both Port Sites	Certificate of Reasonable Assurance (Water Quality Certification)	ADEC	Review of NPDES Applications	Review in Progress

Table 1-1

STATUS OF MAJOR PERMITS AND APPROVALS
(continued)

Project Component	Lease/Permit/Approval	Regulatory Agency	Application Submittal Date	Status
Transportation	Right-of-Way Permit and Easement, ADL 223706 (Ladd)	ADNR/DLWM	June 5, 1987	In adjudication
Port	Tide and Submerged Lands Lease, ADL 223707 (Ladd)	ADNR/DLWM	June 5, 1987	In adjudication
Port	Water Rights, LAS No. to be assigned (Ladd)	ADNR/DLWM	June 5, 1987	Review in Progress
Transportation	Material Sites, ADL 223708 through 223717 (10 sites)(Ladd)	ADNR/DLWM	June 5, 1987	Review in Progress
Transportation	Anadromous Fish Protection Permit, Title 16 (Ladd)	ADF&G	June 5, 1987	Review in Progress
Port	Wastewater Disposal Permit (Ladd)	ADEC	June 5, 1987	Review in Progress
Alaska Coastal Management Program - Phase III; includes air quality permits and other approvals		OMB (state)		Review in Progress
Transportation	Right-of-Way Easement	KPB	April 24, 1987	In adjudication
Mine, Port & Housing	Plan review for sewerage systems of water and wastewater treatment works	ADEC	---	Review in Progress
Mine, Housing, Transportation and Port	Air Quality Control Permit to Operate	ADEC	December 1986 Amended	Review in Progress
Mine	Miscellaneous Burning Permits	ADEC	---	To be submitted

Chapter 2.0

The Proposed Project

2.0 THE PROPOSED PROJECT

2.1 INTRODUCTION

This chapter describes the Diamond Chuitna coal project -- what the various parts (components) of the project are, where they would be located, and how they would function. The applicant's plans for construction and operation of each component (e.g., power source, worker housing, etc.) are described. For some components (e.g., location of the transportation corridor), the EIS scoping process, the third party EIS team, a federal or state agency or the applicant itself have identified more than one option. In these cases, each of the other options is described in addition to the applicant's proposed option.

The mitigation plan included in the project proposal, including mitigation measures committed to by the project applicant for all project components, is described in this chapter. The discussion of environmental consequences (Chapter 5.0) assumes these mitigation measures will be in place if the project is constructed. Chapter 6.0 summarizes the mitigation, reclamation and monitoring requirements imposed by the state of Alaska through the Alaska Surface Coal Mining Program and other state permitting programs; requirements imposed through federal and local permitting programs; and other measures which could be considered by the permitting agencies.

The Alaska Surface Coal Mining Control and Reclamation Act (AS 27.21) and pertinent regulations (11 AAC Chapter 90) require very detailed information about all aspects of the applicant's proposed plan of operation (e.g., water drainage control and treatment, reclamation). The large volume of this information makes it impractical to incorporate it into this EIS. Therefore, this chapter only summarizes the major aspects of the proposed project. However, references to the location of this detailed information in Diamond Alaska Coal Company's 27-volume Permit Application to Conduct Surface Coal Mining (1985) are given for readers who wish to pursue more specific details (see Section 7.7 for locations of the permit application).

2.2 PROJECT OVERVIEW AND COMPONENTS

2.2.1 Introduction

Since the applicant has not yet concluded a final contract for sale of coal, the length of time it would take to develop the project to its full production capacity of 10.9 million Mt (12 million short tons) is unknown, but would occur in stages depending upon economics. As coal production increased, staged development of the mine, housing site, overland coal transportation system, port site, and loading trestle would occur commensurate with production requirements. Under optimal conditions, full production capacity could be reached after four years of operation. However, it is likely that full production would take longer than four years to reach and, thus, the full impacts of the completed project would not occur until some undetermined time in the future.

The project overview below generally describes the project at full production. Most mine development impacts would be of lower magnitude before full production is reached. The exceptions would be short-term activities such as hauling coal by truck. This would occur only during the early years of the project and may cause greater impacts than transporting coal by conveyor.

2.2.2 Project Overview

Development of the Diamond Chuitna project would involve a surface coal mine located approximately 72 km (45 mi) west of Anchorage (Fig. 1-1). The coal would be surface mined by large shovels and draglines and hauled by trucks to a nearby mine area conveyor for transport to a mine service area for crushing. The crushed coal initially would be hauled in trucks from the mine service area to a port on Cook Inlet. After two years of mine operation, coal would be moved from the mine service area to the port on a conveyor. At lower production levels, the coal would be loaded from a short trestle at the port onto barges for transport to market. At higher production levels, coal would be loaded from a long trestle onto ocean-going ships.

Under the optimal, four-year full production development schedule, production in the first year of mine operation would be approximately 1.8 million Mt (2 million short tons). Production would increase to about 3.6 Mt (4 million short tons) in the second year. In the third year, production would increase to approximately 5.4 million Mt (6 million short tons), reaching 10.9 million Mt (12 million short tons) per year by the fourth year of mine operation.

Figure 2-1 shows the locations of the project component options used to formulate the action alternatives. The mine, overburden stockpile, and mine service area all would be located on land owned by the State of Alaska (Fig. 4-1).

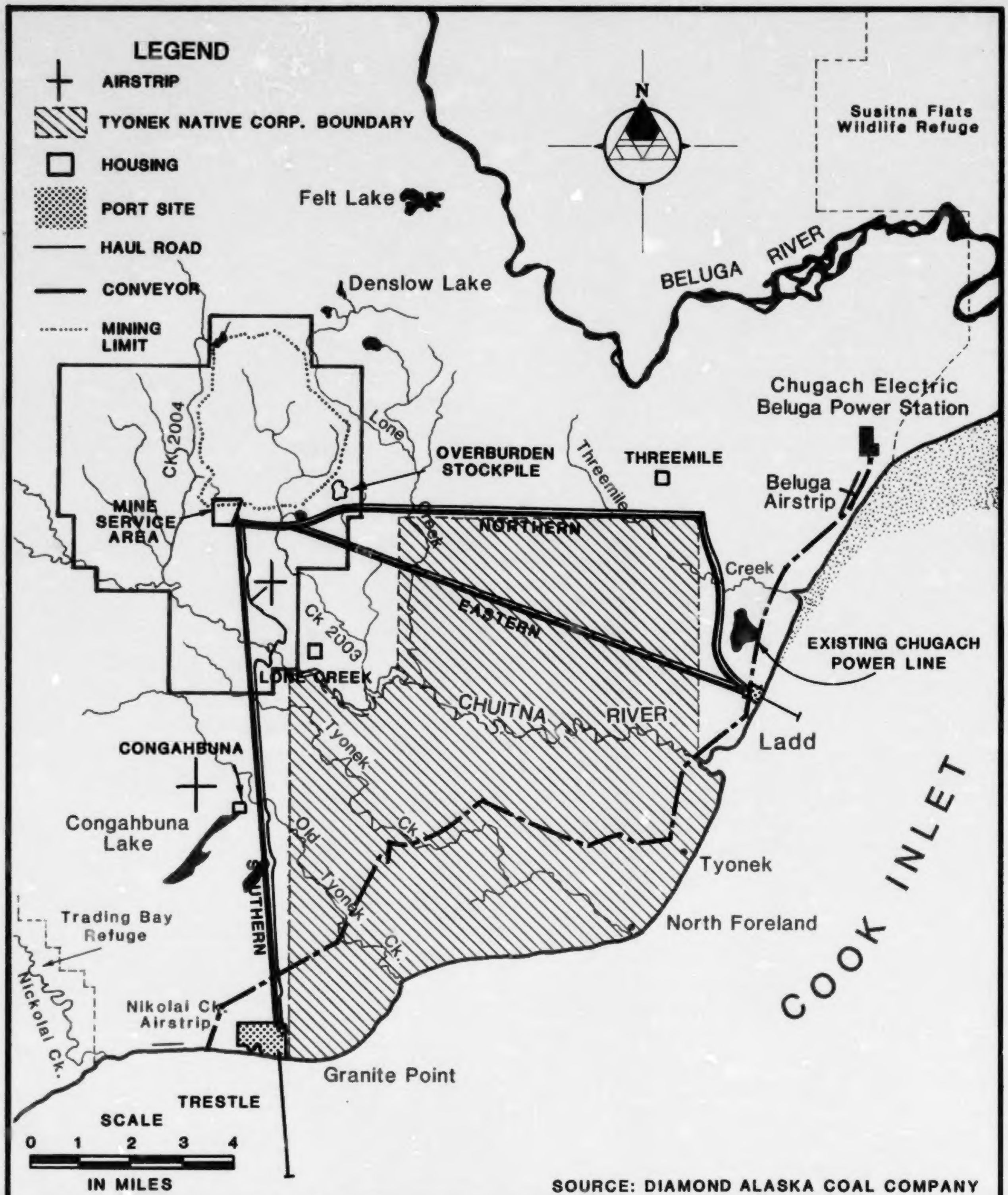
Three transportation corridor options are incorporated into the action alternatives evaluated in this EIS: northern/Ladd, eastern/Ladd, and southern/Granite Point (Fig. 2-1). The northern corridor would run east from the mine service area across state land toward the Beluga airstrip, then turn south southeast across land owned by Cook Inlet Region Native Corporation to a port site at Ladd on land owned by the Kenai Peninsula Borough (KPB). The eastern corridor would run in a straight line southeast from the mine service area across state land and land owned by the Tyonek Native Corporation (TNC) to the same port site at Ladd. The southern corridor would run in a straight line south from the mine service area across state and KPB land to a port site on state land at Granite Point.

The applicant wishes to retain two of the transportation corridor/port site options (southern/Granite Point and northern/Ladd). Two alternatives incorporating these options are therefore identified in this EIS as the applicant's Proposed Project. The applicant's proposal entails development of only one of these transportation corridors. The haul road and conveyor would both be constructed within the same corridor leading to the associated port site (either Ladd or Granite Point). Regardless of which transportation corridor and port site would be ultimately developed, the applicant plans to initially utilize the existing Ladd barge landing and the existing road between Ladd and the mine site for the staging of equipment and construction access.

Three housing site options are evaluated in the EIS. The Lone Creek and Threemile housing sites are located on state land, while the Congahbuna housing site and airstrip are located on KPB land.

2.2.3 Project Components and Options

In reviewing this document, it is important that the reader understand the relationship among the terms "component", "option", and "alternative." The project has several components, each one a necessary part of an entire viable mining project (e.g., the mine, transportation system, port site, housing site, etc.). For each component there may be one or more options (e.g., a southern or a southeastern transportation corridor location option). An alternative is a combination of options (one for each component) that constitutes an entire functioning project.


LEGEND
AIRSTRIP
TYONEK NATIVE CORP. BOUNDARY
HOUSING
PORT SITE
HAUL ROAD
CONVEYOR
MINING LIMIT
N
Felt Lake
Denslow Lake
Susitna Flats Wildlife Refuge
BELUGA RIVER
Chugach Electric Beluga Power Station
Beluga Airstrip
Ck 2004
Lone
OVERBURDEN STOCKPILE
Threemile
THREEMILE
MINE SERVICE AREA
NORTHERN
Creek
Creek
EASTERN
Ck 2003
EXISTING CHUGACH POWER LINE
LONE CREEK
CHUITNA RIVER
Ladd
CONGAHBUNA
Tyonek
Congahbuna Lake
Ck.
Old
Tyonek
Tyonek
SOUTHERN
North Foreland
COOK INLET
Trading Bay Refuge
Ck.
Nickolai Ck.
Nikolai Ck. Airstrip
Granite Point
TRESTLE
SCALE
0 1 2 3 4
IN MILES

SOURCE: DIAMOND ALASKA COAL COMPANY

FINAL PROJECT OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 2-1

For most components the EIS scoping process initially identified at least two options. The process by which this large number of options was screened to reduce the number to a manageable level and how the ultimate project alternatives were selected is described in detail in Chapter 3.0. The descriptions below for each project component, therefore, address only those component options which were ultimately retained and which are specifically addressed in at least one of the action alternatives for each scenario. For each component where more than one option remains, the applicant's preferred option is described first.

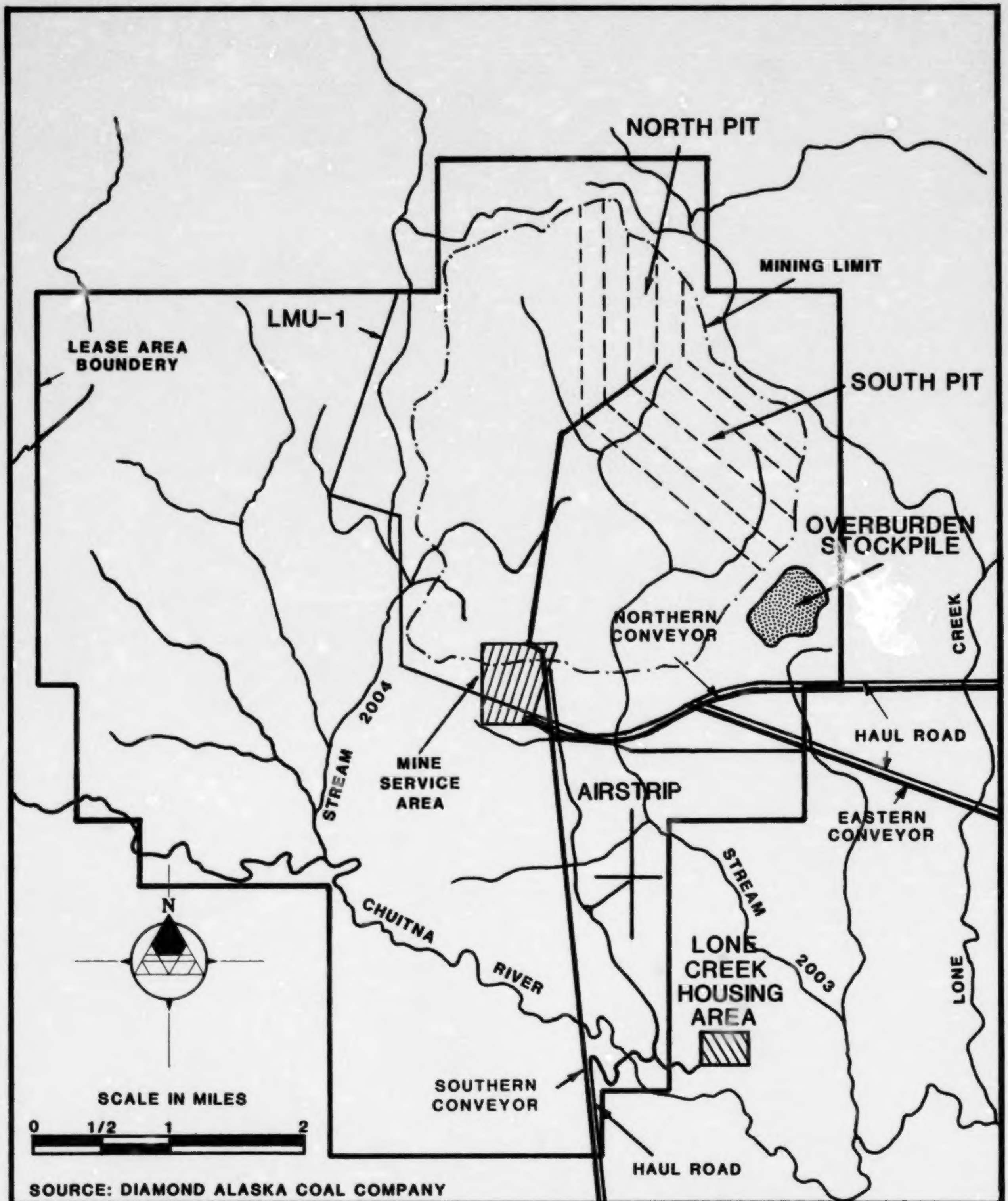
2.3 MINE AREA FACILITIES

2.3.1 Location and Size

The mine would be located entirely within logical mining unit no. 1 (LMU-1), one of three units within the lease area and the only one involved in the proposed 34-year project (Fig. 2-2). LMU-1 covers approximately 4,047 ha (10,000 ac) and contains a minimum of 299 million Mt (330 million short tons) of coal (recoverable).

The sizes and locations of the coal seams, the nature of the overburden* and interburden*, and the economics involved in mining the coal are such that only surface mining would be feasible. The coal is contained in five major seams, each varying in thickness between 1.8 and 6.1 m (6-20 ft), with a cumulative stripping ratio of 3.9:1 (i.e., 3.9 m^3 of overburden to 1 Mt of recoverable coal [4.6:1, or 4.6 yd^3 per short ton]). The actual area to be mined (mining limit) would be approximately 2,029 ha (5,014 ac) in size and would be divided into north and south pits (Fig. 2-2) which would be mined simultaneously but in separate operations during the life of the project. These pits would begin on the northeast edge of the mining limit and proceed generally west and southwest, respectively, during the life of the project.

A maximum of 182 ha (450 ac) of pit would be open at any one time. An additional maximum of 61 ha (150 ac) around the pit would be disturbed at any one time in clearing and grubbing vegetation in preparation for stripping overburden, or recontouring in preparation for revegetation. A total of approximately 63 ha (155 ac) per year would be cleared for mining in two periods - most likely spring and fall. Maximum depth of the pit would range from 6.1 m (20 ft) during the first year of production to approximately 122 m (400 ft) in the final years of the project. Average pit depth would be about 61 m (200 ft).


NORTH PIT
MINING LIMIT
LMU-1
LEASE AREA BOUNDERY
SOUTH PIT
OVERBURDEN STOCKPILE
NORTHERN CONVEYOR
CREEK
HAUL ROAD
STREAM 2004
MINE SERVICE AREA
AIRSTRIP
EASTERN CONVEYOR
N
STREAM 2003
LONE CREEK HOUSING AREA
CHUITNA RIVER
LONE
SOUTHERN CONVEYOR
SCALE IN MILES
0
1/2
1
2
HAUL ROAD

SOURCE: DIAMOND ALASKA COAL COMPANY

FINAL MINE AREA OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement | FIGURE 2-2

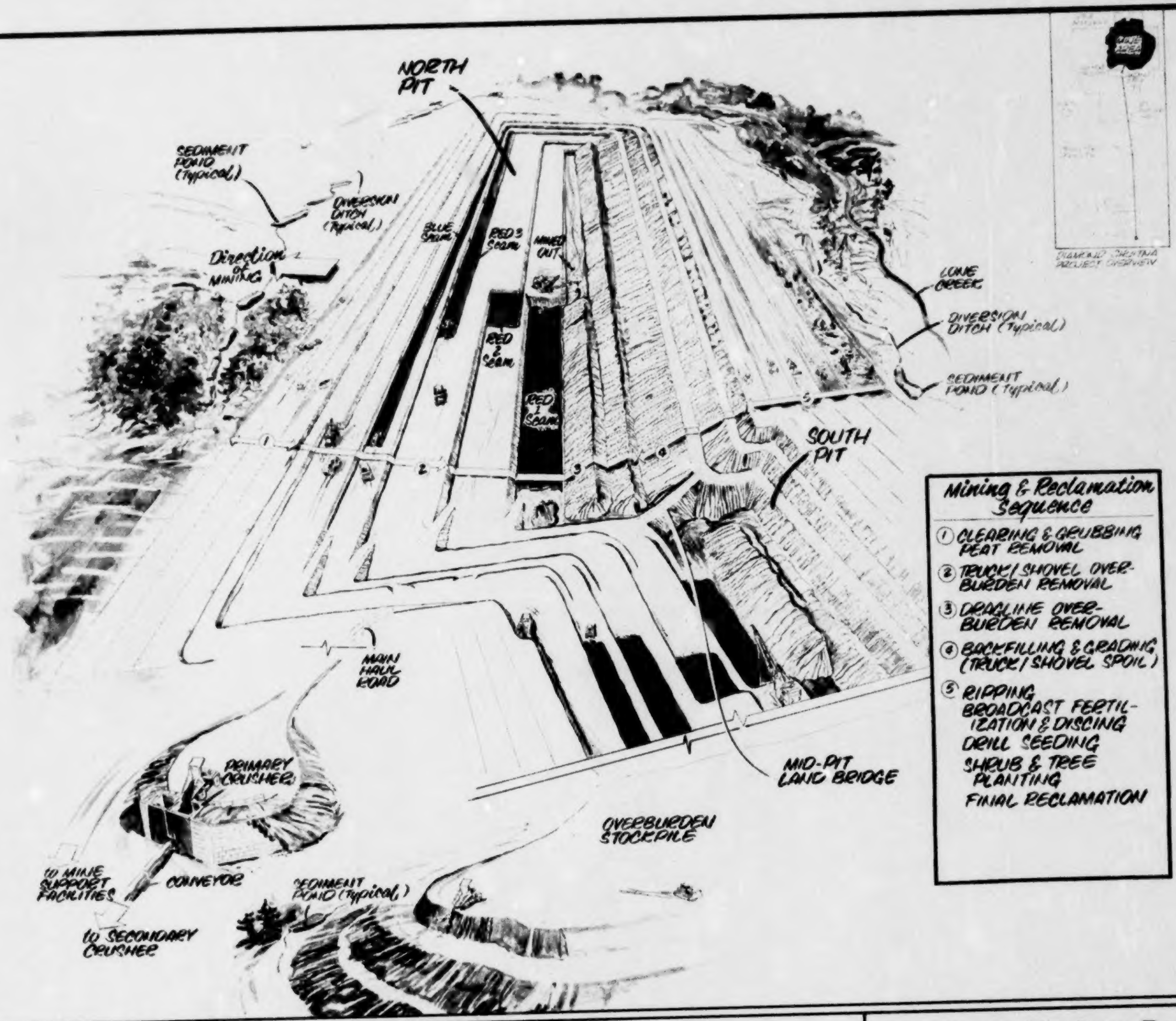
2.3.2 Mining Sequence and Methods

Mining activities would begin with the clearing and grubbing of all trees, brush, stumps, and other vegetation. This slash material would be burned, if conditions allowed, or buried under adequate spoil in the mine pit if burning were not possible. Topsoil will be removed and stored in a separate pile for use during revegetation. Then, approximately 16.8 million m^3 (22 million yd^3) of overburden, excluding topsoil, initially would be excavated (the "box cut"*) and permanently placed in an overburden stockpile (Fig. 2-2). After completion of the box cut, as new topsoil and overburden are excavated from the pit's advancing face to expose the coal, the overburden would be put onto the trailing edge of the pit from which the coal would have already been removed (Fig. 2-3). This area would then be reclaimed by regrading it to its approximate premining contours, including stream locations and drainages, covering it with topsoil, and then revegetating it. Because of an approximate 18 percent swell factor associated with the reclaimed overburden, the original surface contours could be approximated without use of the material in the permanent overburden stockpile.

During the first year of production, mining methods would employ shovels (15-19 m^3 [20-25 yd^3] capacity), overburden haul trucks (136-154 Mt [150-170 short ton] payloads), and coal haul trucks (91-136 Mt [100-150 short ton]) for stripping and coal recovery. A 44 m^3 (57 yd ^{3}) dragline would be added later with a smaller 27 m^3 (35 yd^3) dragline added when full production was resumed. At full production capacity, the draglines would be used for overburden and interburden removal while the shovels and haul trucks would be used for prestripping of overburden.

Coal would be loaded onto trucks directly from the seams by hydraulic backhoes, shovels, or front end loaders. Because of the unconsolidated nature of both the overburden and interburden and the tendency of the coal to crumble, no major blasting is anticipated. Some infrequent secondary blasting would be required, primarily to move large glacial erratic boulders which are scattered throughout the overburden. Such blasting would occur an average of once per week.

Run-of-the-mine coal would be hauled by truck to a primary crusher located in front of the advancing mine face between the north and south pits (Fig. 2-3). The primary crusher would be moved every three to five years. The coal would be crushed to a maximum size of 15 cm (6 in) and carried about 3,962 m (13,000 ft) by a 1.4 m (54 in), two-span partially enclosed mine area conveyor system to a secondary crusher (located in the mine service area outside the mining


NORTH PIT
SEDIMENT POND (Typical)
DIVERSION DITCH (Typical)
Direction of Mining
BLUE Seam
RED 3 Seam
MINED OUT
RED 2 Seam
RED 1 Seam
SOUTH PIT
LONE CREEK
DIVERSION DITCH (Typical)
SEDIMENT POND (Typical)
DIAMOND CHUITNA PROJECT OVERVIEW
MAIN HAUL ROAD
PRIMARY CRUSHER
to MINE SUPPORT FACILITIES
CONVEYOR
to SECONDARY CRUSHER
SEDIMENT POND (Typical)
OVERBURDEN STOCKPILE
MID-PIT LAND BRIDGE
Mining & Reclamation Sequence
① CLEARING & GRUBBING PEAT REMOVAL
② TRUCK/SHOVEL OVERBURDEN REMOVAL
③ DRAGLINE OVERBURDEN REMOVAL
④ BACKFILLING & GRADING (TRUCK/SHOVEL SPOIL)
⑤ RIPPING BROADCAST FERTILIZATION & DISCING
DRILL SEEDING
SHRUB & TREE PLANTING
FINAL RECLAMATION

ARTIST'S ILLUSTRATION – MINING AND RECLAMATION SEQUENCE

Diamond Chuitna Environmental Impact Statement

FIGURE 2–3

limit) where it would be crushed to a maximum size of 5 cm (2 in) and then weighed. The mine area conveyor will be elevated in at least four locations so that the bottom of the horizontal steel support pipe will be a minimum of 2.4 m (8 ft) above ground level to permit crossing by moose and bears.

2.3.3 Water Control and Treatment

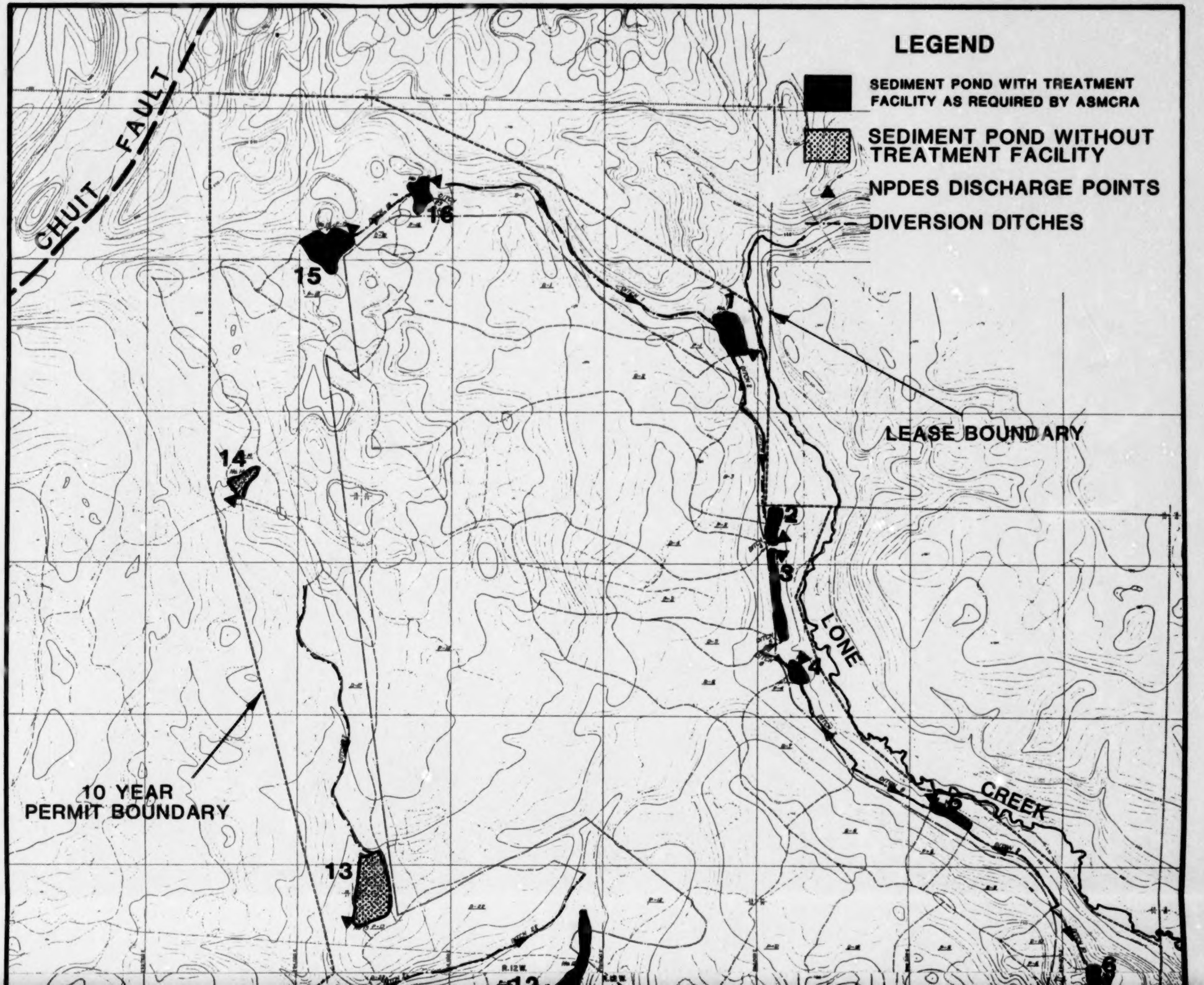
The discussion below summarizes the major aspects of the proposed water drainage control and treatment system. More detailed information may be found in Vol. XVII, Sec. 4.12, of the state surface mine permit application (Diamond Alaska Coal Company 1985). The two water control processes needed in the mine area to handle surface and ground-water flows both within and around the active mine pit are described below. During the initial 10 years of operation, portions of streams 200304 and 200305 would be mined and a sediment pond would be located in Stream 200305. A major portion of Stream 2003 (Fig. 2-2) would be displaced during the later years of the project.

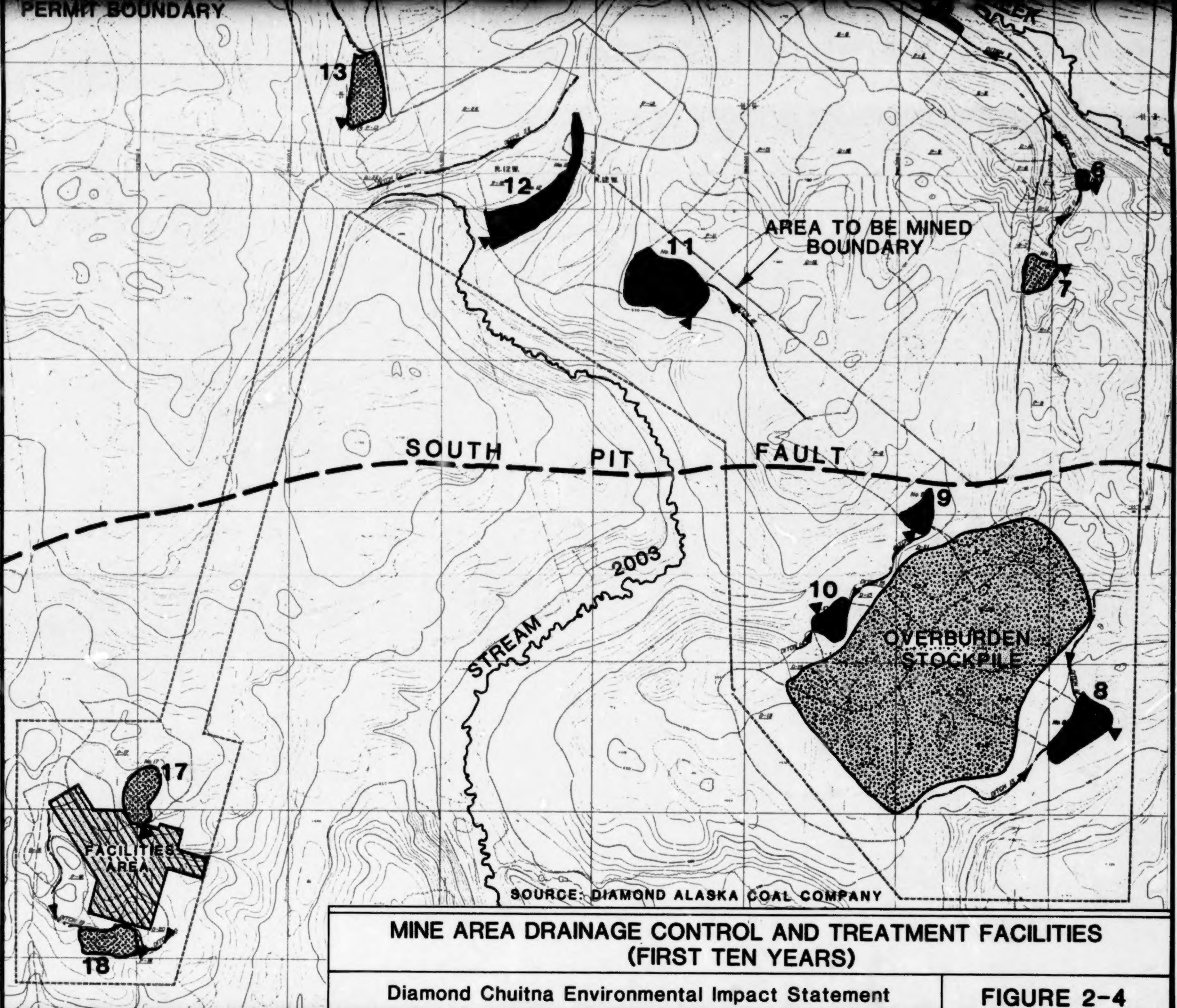
2.3.3.1 Runoff from Areas Outside the Active Mine Pit

The area to be mined during initial 10 years of operation is topographically situated such that it would receive little natural runoff from surrounding undisturbed areas. Thus, little runoff would have to be diverted around the mining area for discharge into existing drainages.

The primary collection ditch and sediment pond system for runoff from within the area to be mined will be constructed prior to mining and will be maintained until completion of reclamation (Fig. 2-4). Note that this system covers only the first 10 years of operation (7 years of mining). The collection ditches will carry runoff from disturbed and undisturbed areas within the area to be mined, the overburden stockpile, and mine service area to sediment ponds. These ponds will function by retaining the water to allow suspended solids to settle out prior to discharge to existing drainages. Depending upon the location, amount and quality of the collected water, it might also be handled or controlled by various other methods including sediment treatment structures, dugout pond/filter dams, sediment filter fabrics, gravel pads, and vegetation barriers.

All discharges will meet applicable water quality standards by: (1) being discharged as planned; (2) the use of mixing zones; or, (3) additional treatment processes. A mixing zone is a limited area or volume of water where dilution and mixing of wastewater from a point source of


LEGEND
SEDIMENT POND WITH TREATMENT FACILITY AS REQUIRED BY ASMCRA
SEDIMENT POND WITHOUT TREATMENT FACILITY
NPDES DISCHARGE POINTS
DIVERSION DITCHES
CHUIT FAULT
LEASE BOUNDARY
10 YEAR PERMIT BOUNDARY
LONE
CREEK
1
2
3
4
5
6
13
14
15
16


PERMIT BOUNDARY
13
12
11
AREA TO BE MINED
BOUNDARY
6
7
SOUTH PIT FAULT
9
10
8
OVERBURDEN
STOCKPILE
STREAM 2003
17
FACILITIES
AREA
18

SOURCE: DIAMOND ALASKA COAL COMPANY

MINE AREA DRAINAGE CONTROL AND TREATMENT FACILITIES
(FIRST TEN YEARS)

Diamond Chuitna Environmental Impact Statement

FIGURE 2-4

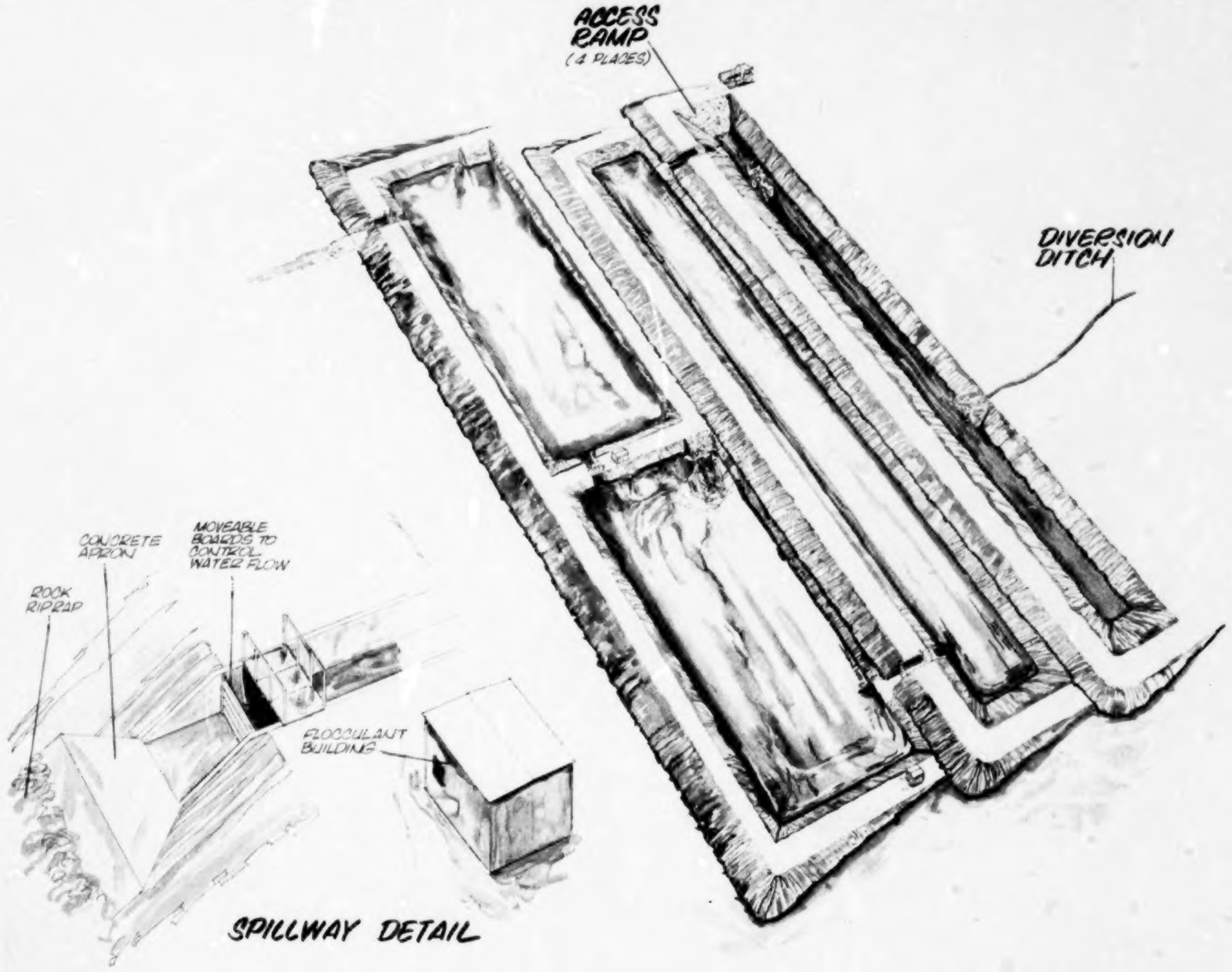
pollution is allowed to occur. Numeric water quality criteria can be exceeded in the mixing zone as long as acutely toxic conditions are prevented (EPA 1983). The rationale is that a small area of degradation can exist without causing adverse effects to the overall water body. EPA (1983), however, states that careful consideration must be given to the appropriateness of a mixing zone where a substance discharged is bioaccumulative, persistent, carcinogenic, mutagenic, or teratogenic. Federal guidance (EPA 1983) considers location, size, shape, outfall design, and in-zone quality to determine the appropriateness of a mixing zone. Alaska's mixing zone provision is presently set out in 18 AAC 70.032 of the water quality standards. This regulation adheres to federal guidance for mixing zones. The permittee has requested and received approval from ADEC for a mixing zone to meet the state's turbidity water quality standard. The proposed final mine NPDES permit (AK-004357-5, part I, B.6 included in Appendix D) includes a reference to the applicable mixing zone.

Where other treatment is necessary before discharge, e.g., flocculation, additional treatment facilities will be built in conjunction with the sediment ponds. Figure 2-5 shows a typical two-structure sediment pond system with flocculent building. The collection ditch/sediment pond system will be redesigned and rebuilt at intervals to accommodate drainage needs using the experience gained during the first 10 years of operation.

On the northwestern and western sides of the mine area, space is available for location of adequately sized sediment ponds to handle sediment loads with little or no additional treatment. However, on the northeastern and eastern sides of the mine area, space would be limited between the mine pit and Lone Creek. In these areas, sediment ponds with additional sediment treatment structures will be necessary during periods of high runoff. Then treatment structures will consist of a series of excavations and embankments using baffles and selective routing to control, treat, and allow monitoring of runoff prior to discharge into Lone Creek.

Once the water is treated, it will be released from the ponds into natural drainages at the 18 points shown in Figure 2-4. Outflow from sediment pond concrete spillways will be controlled by a riprap* energy dissipator to minimize potential erosion.

The sediment ponds will be dredged periodically with the dredged material put into the mine pit and covered by at least 1.2 m (4 ft) of spoil material.


ACCESS RAMP
(4 PLACES)
DIVERSION DITCH
CONCRETE APRON
MOVEABLE BOARDS TO CONTROL WATER FLOW
ROCK RIPRAP
FLOCCULANT BUILDING
SPILLWAY DETAIL

ARTIST'S ILLUSTRATION –
TYPICAL SEDIMENT POND

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Impact Statement

FIGURE 2–5

2.3.3.2 Active Mine Pit Water

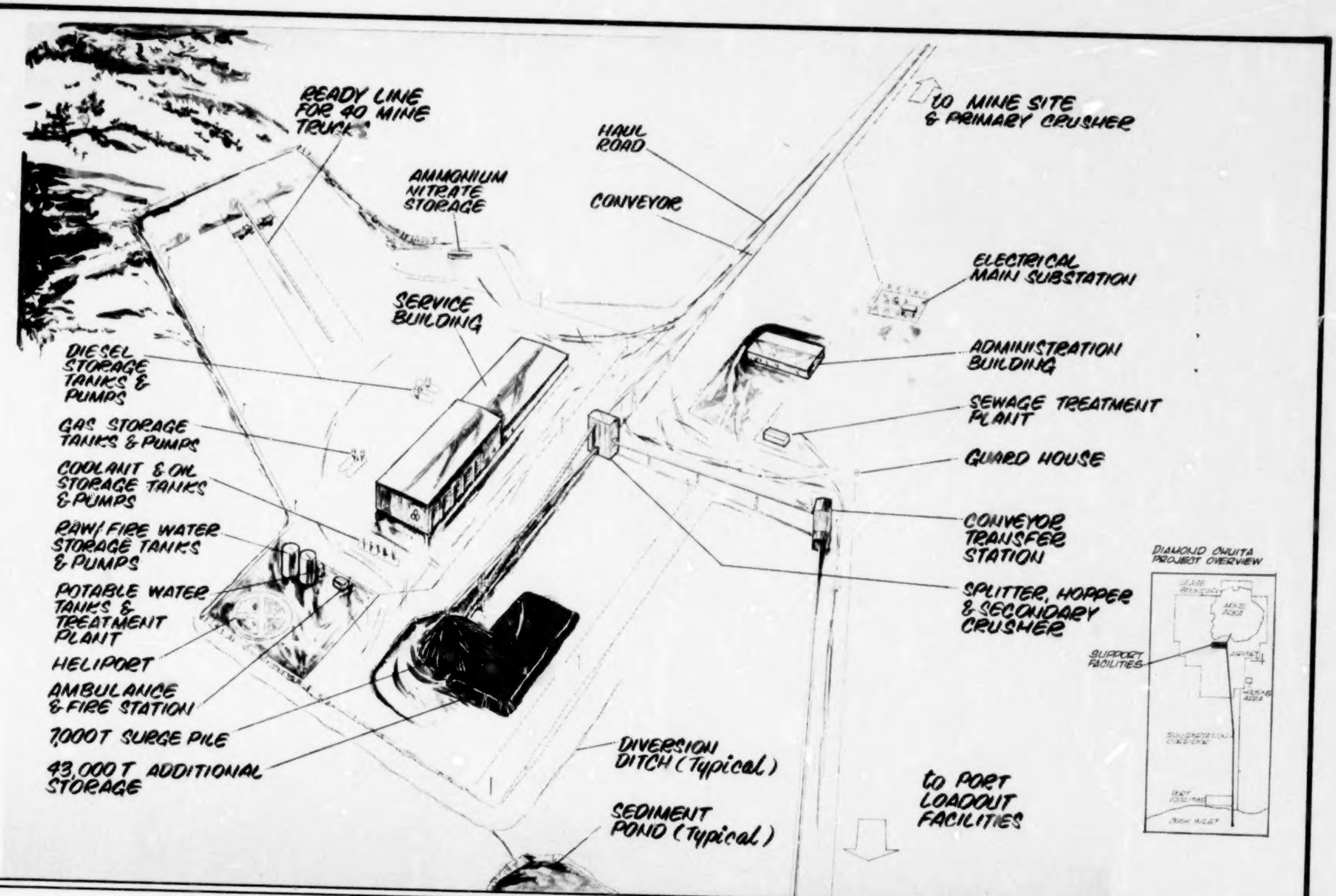
Control of surface runoff from rainfall and snowmelt within the active mine pit and ground water that would drain into the pit during the mining process will be handled in the same manner. Water will be collected in sumps* with a reserve storage capacity to allow initial settling of suspended solids and any additional treatment which might be necessary (e.g., buffering, flocculation). The water will then be pumped from the active mining areas to the adjacent larger sediment control ponds for treatment, monitoring, and discharge into drainages of Lone Creek and Stream 2003. During a given year (within the first 10 years), approximately 50 percent of the water pumped from the active mine pit ultimately will be discharged into the Lone Creek drainage. At any time, however, discharges into either creek, or both simultaneously, could occur depending upon the active mining pit location.

2.3.4 Overburden Stockpile

At the start of operations, approximately 16.8 million m^3 (22 million yd^3) of overburden from the box cut (excluding topsoil) would be excavated and permanently placed in an overburden stockpile (Fig. 2-2). Because of an approximate 18 percent swell factor associated with the reclaimed overburden, the original surface contours could be duplicated without use of the material in the permanent overburden stockpile. This stockpile would be approximately 61 m (200 ft) high, 1,280 m (4,200 ft) long and 670 m (2,200 ft) wide and would cover about 81 ha (200 ac). No further material would be added. The stockpile will be stabilized, graded and then revegetated to prevent erosion. Runoff from the stockpile will be handled in the same manner as described above for the mine area using a treatment system consisting of collection ditches and three sediment ponds (Fig. 2-4). Topsoil from the box cut will be stockpiled in a separate area.

2.3.5 Mine Service Area

The permanent mine service area would be located on the southern edge of the mining limit (Fig. 2-2). The approximately 22 ha (55 ac) area would include the main administration building, a service building housing the principal maintenance, warehouse and service facilities; equipment ready lines; water, diesel fuel, gasoline and lubricant storage; electrical substation; ambulance and fire station; water and sewage treatment plants; emergency power system; explosives magazine; heliport; and emergency and safety facilities (Fig. 2-6). The area will not be fenced. No one will be housed at the mine service area.


READY LINE FOR 40 MINE TRUCKS
HAUL ROAD
to MINE SITE & PRIMARY CRUSHER
AMMONIUM NITRATE STORAGE
CONVEYOR
ELECTRICAL MAIN SUBSTATION
SERVICE BUILDING
ADMINISTRATION BUILDING
DIESEL STORAGE TANKS & PUMPS
SEWAGE TREATMENT PLANT
GAS STORAGE TANKS & PUMPS
GUARD HOUSE
COOLANT & OIL STORAGE TANKS & PUMPS
CONVEYOR TRANSFER STATION
RAW/FIRE WATER STORAGE TANKS & PUMPS
DIAMOND CHUITA PROJECT OVERVIEW
POTABLE WATER TANKS & TREATMENT PLANT
SPLITTER, HOPPER & SECONDARY CRUSHER
LEASE BOUNDARY
MINE AREA
SUPPORT FACILITIES
AIRPORT
HOUSING AREA
TRANSPORTATION CORRIDOR
PORT FACILITIES
COOK INLET
HELIPORT
AMBULANCE & FIRE STATION
7,000T SURGE PILE
43,000 T ADDITIONAL STORAGE
DIVERSION DITCH (Typical)
SEDIMENT POND (Typical)
to PORT LOADOUT FACILITIES

ARTIST'S ILLUSTRATION – MINE SERVICE AREA

Diamond Chuitna Environmental Impact Statement

FIGURE 2-6

Coal from the primary crusher at the mine would enter the mine service area by conveyor and pass through a splitter-hopper* which would feed coal to either the secondary crusher (and thence by conveyor to the port) or to a surge pile or an emergency storage pile in the service area. The coal would not be washed or otherwise processed. The two coal piles would have a combined capacity of approximately 45,360 Mt (50,000 short tons) and would serve to offset differences in conveyor capacities and compensate for downtime in mining operations.

Runoff from the mine facilities area itself, including any water used for dust control spraying, will be collected by a ditch system and sent to two sediment ponds (11 and 12) (Fig. 2-4) for settling and treatment to meet water quality standards before being released into the Stream 2003 drainage. Flocculent equipment will be installed in ponds 1-6, 8-12, 15 and 16 prior to the ponds becoming operational.

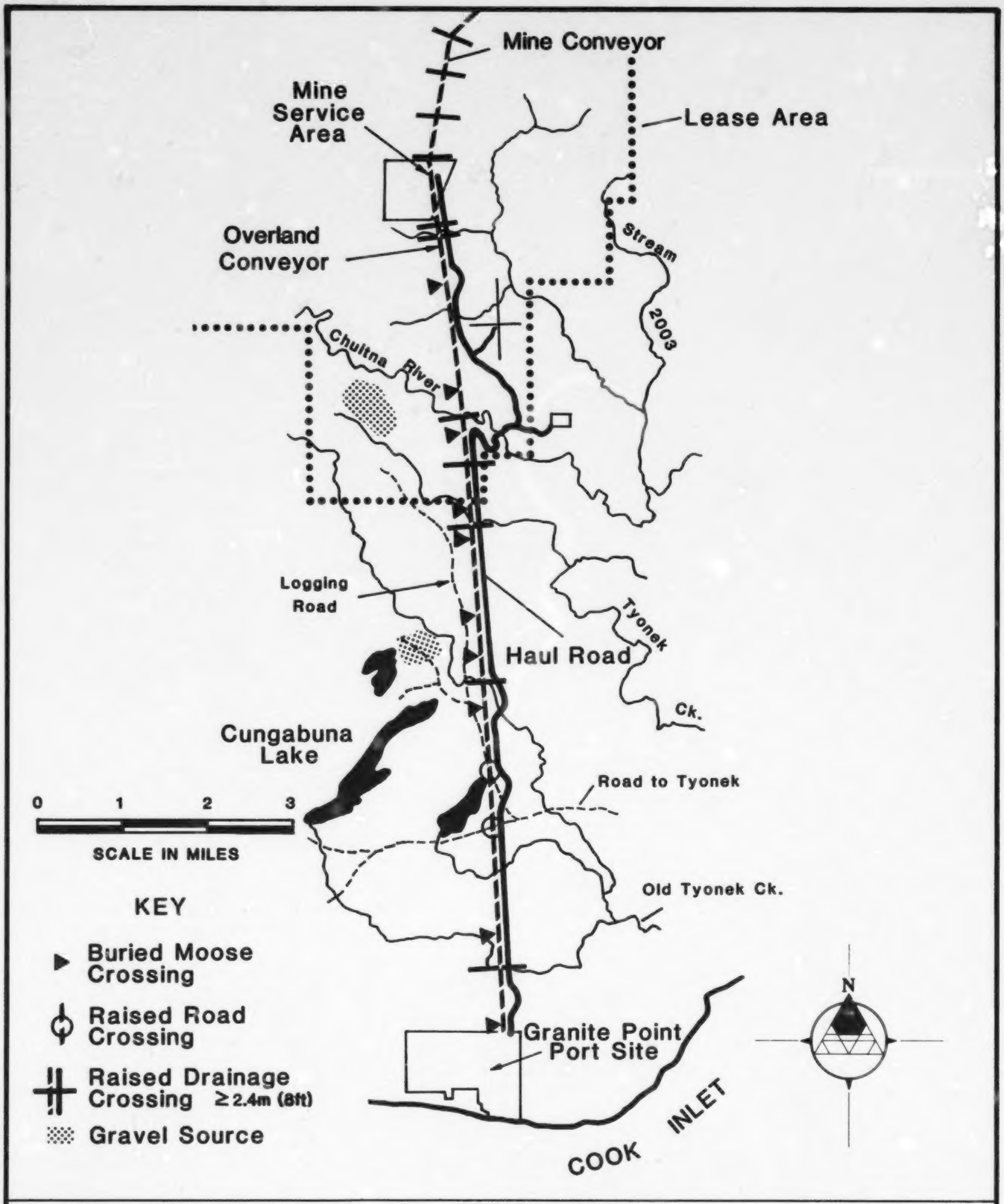
Sanitary waste water generated at the facility will be treated in a packaged treatment plant at primary and secondary levels. Effluent will be carried in a pipeline buried next to the road to the housing area where it will join the treated effluent pipeline from the housing site and be discharged into the Chuitna River directly south of the housing site.

Nonorganic solid wastes will be deposited in fenced and enclosed dumpsters located throughout the service area and collected on a regular basis. A temporary fenced landfill near the mine site will be used for solid waste disposal only during construction, and will then be closed. After that, these wastes will be trucked to a large, permanent, fenced disposal site in the vicinity of the mine. Solid wastes will not be put into the mine pit itself. Organic wastes will be deposited in separate fenced and enclosed dumpsters within the service area and hauled to the housing area organic waste incinerator. Hazardous wastes will be handled completely separately and will be removed from the project area entirely for disposal at an authorized hazardous waste site.

2.4 TRANSPORTATION SYSTEM

2.4.1 Conveyor

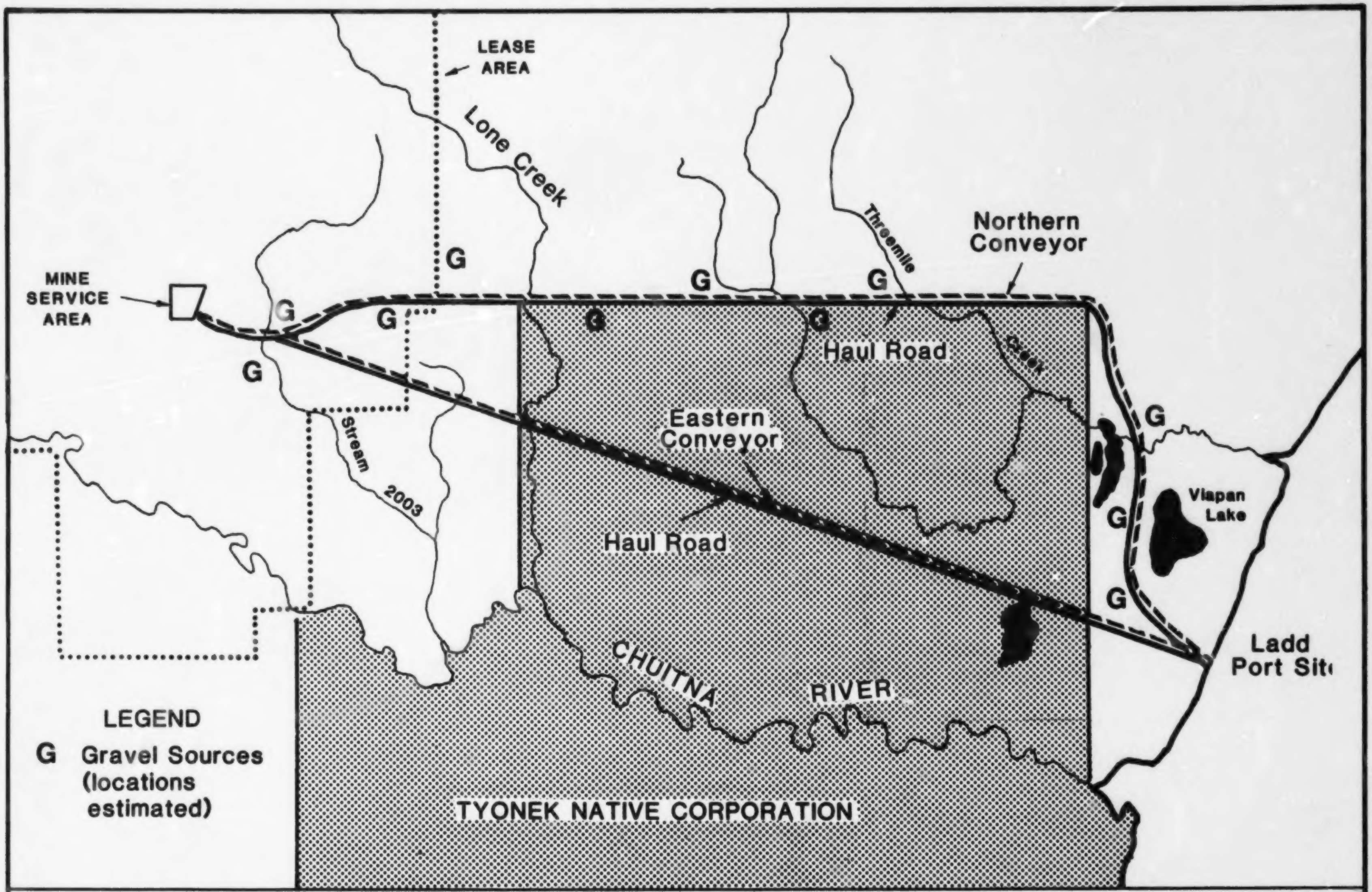
If either the southern or eastern transportation corridor is selected, an approximately 15.9 km (10 mi) single-span conventional continuous belt conveyor would transport coal from the mine service area to a port on Cook Inlet (Figs. 2-7 and 2-8). The northern corridor, if selected, would require an approximately 22 km (13.8 mi) two-span conveyor (Fig. 2-9). The southern corridor would have six minor stream crossings (two unnamed tributaries to Stream 2003 north of the Chuitna River, Tyonek Creek, Old Tyonek Creek, and two unnamed


Mine Conveyor
Mine Service Area
Lease Area
Overland Conveyor
Stream 2003
Chuitna River
Logging Road
Tyonek
Haul Road
Ck.
Cungabuna Lake
Road to Tyonek
0 1 2 3
SCALE IN MILES
Old Tyonek Ck.
KEY
▶ Buried Moose Crossing
Raised Road Crossing
Raised Drainage Crossing ≥2.4m (8ft)
Gravel Source
Granite Point Port Site
N
COOK INLET

SOUTHERN CORRIDOR CONVEYOR AND HAUL ROAD LOCATIONS

Diamond Chuitna Environmental Impact Statement

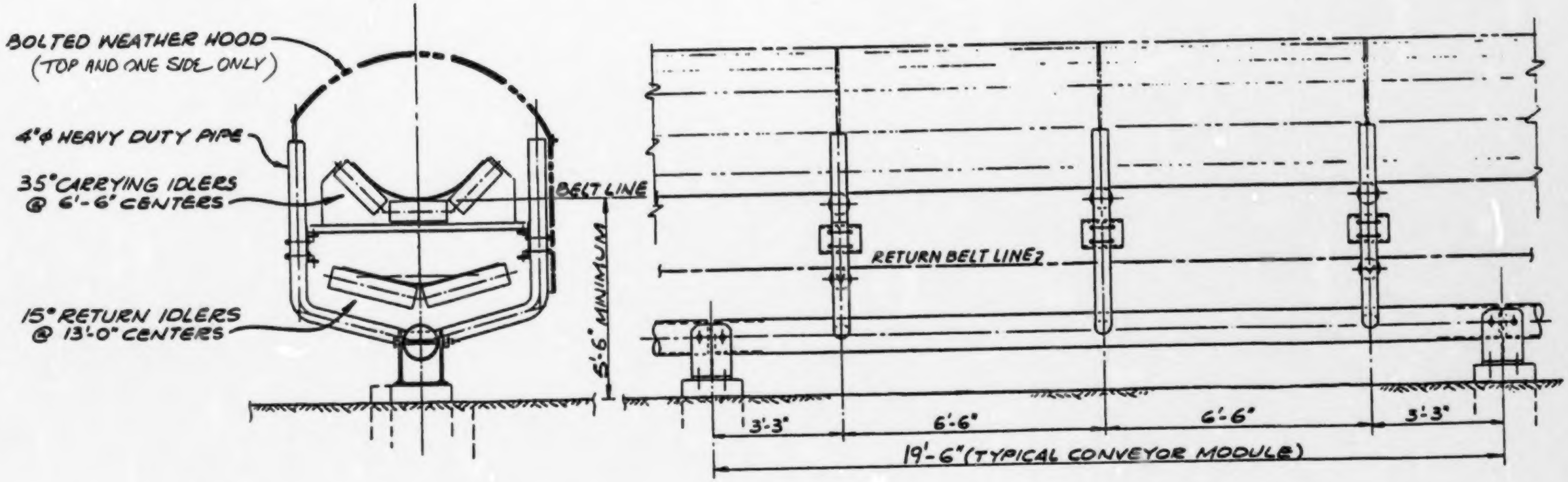
FIGURE 2-7


LEASE AREA
Lone Creek
G
MINE SERVICE AREA
G
G
G
G
G
G
Threemile
Northern Conveyor
Haul Road
Creek
Stream 2003
Eastern Conveyor
Haul Road
G
G
G
Viapan Lake
Ladd Port Sit
CHUITNA
RIVER
TYONEK NATIVE CORPORATION
LEGEND
G Gravel Sources (locations estimated)

EASTERN AND NORTHERN CONVEYOR AND ACCESS/HAUL ROAD LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 2-8


BOLTED WEATHER HOOD
(TOP AND ONE SIDE ONLY)
4"φ HEAVY DUTY PIPE
35° CARRYING IDLERS
@ 6'-6" CENTERS
15° RETURN IDLERS
@ 13'-0" CENTERS
BELT LINE
5'-6" MINIMUM
RETURN BELT LINE
3'-3"
6'-6"
6'-6"
3'-3"
19'-6" (TYPICAL CONVEYOR MODULE)

SOURCE: Diamond Alaska Coal Company

TYPICAL CONVEYOR MODULE
AND CROSS SECTION

Diamond Chuitna Environmental
Impact Statement

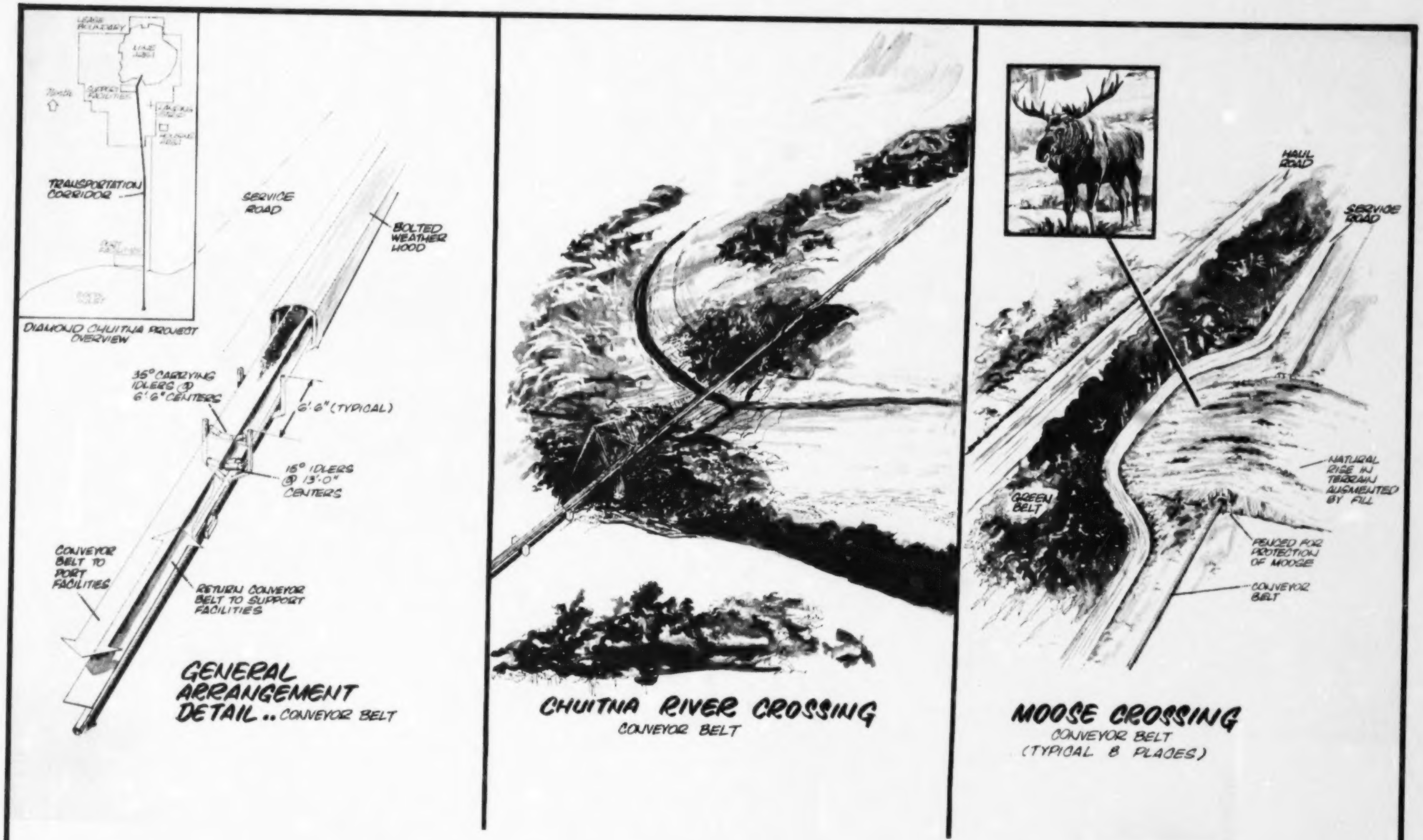
FIGURE 2-9

tributaries to Old Tyonek Creek) and one major stream crossing (Chuitna River). The northern corridor would also cross six small streams including two tributaries to Stream 2003, Lone Creek, two tributaries to Threemile Creek, and the Threemile Creek mainstream. The eastern corridor would cross 3-4 streams including two tributaries to Stream 2003 and Lone Creek. Neither the eastern nor the northern corridors would have major stream crossings comparable to the southern corridor's Chuitna River crossing.

The entire conveyor structure would be supported by a horizontal steel pipe typically elevated about 0.6 m (2 ft) above the ground surface on pedestal support piers spaced approximately 6.1 m (20 ft) apart (Figs. 2-9 and 2-10). The entire structure typically would be 2.9 m (9.6 ft) tall and 2.2 m (7.3 ft) wide. The coal-carrying belt would be a minimum of 1.7 m (5.5 ft) above the ground and would be supported by heavy duty pipe yokes attached to the horizontal steel pipe at 2 m (6.5 ft) intervals. The conveyor belt would be 1.2 m (48 in) wide and capable of moving about 1,633 Mt (1,800 short tons) of coal per hour. The conveyor belt will be enclosed on top and one side with a weatherhood to protect the coal from moisture and wind. The open side would permit visual inspection of and access to the rollers for maintenance. Wherever the conveyor crosses streams, it will be partially enclosed on the underside (underpanning) to prevent coal or dust from entering the stream. If a conveyor is built across the Chuitna River (southern corridor), it will be totally enclosed and suspended about 52 m (170 ft) above the river by cables (Fig. 2-9).

To permit moose, bears, and people to cross the conveyor, at appropriate locations it would be buried for a minimum of 61 m (200 ft) in large diameter culverts or arch spans (Fig. 2-10). At other locations, e.g., stream crossings, the conveyor will be elevated a minimum of 2.4 m (8 ft) above ground level. There will also be places where the conveyor will be raised to permit existing roads to pass underneath (Fig. 2-7). The conveyor will be gradually elevated to a clearance of 9.4 m (30 ft) at these road crossings, taking about 61 m (200 ft) on each side of the road to rise to that height from its normal elevation. In combination along any corridor, the maximum distance between crossings (underpass or overpass) will be approximately 2,000 m (2,187 yd), with an average center-to-center distance between crossings of approximately 880 m (962 yd).

Although locations for conveyor crossings have been identified for the southern corridor (Fig. 2-7), final locations will be determined by field inspection of the final alignment. Crossings on the northern and eastern corridors


LEASE BOUNDARY
MINE AREA
North
SUPPORT FACILITIES
TRANSPORTATION CORRIDOR
PORT FACILITIES
COOK INLET
DIAMOND CHUITNA PROJECT OVERVIEW
SERVICE ROAD
BOLTED WEATHER HOOD
35° CARRYING IDLERS @ 6'6" CENTERS
6'6" (TYPICAL)
15° IDLERS @ 13'-0" CENTERS
CONVEYOR BELT TO PORT FACILITIES
RETURN CONVEYOR BELT TO SUPPORT FACILITIES
HAUL ROAD
SERVICE ROAD
GREEN BELT
NATURAL RISE IN TERRAIN AUGMENTED BY FILL
FENCED FOR PROTECTION OF MOOSE
CONVEYOR BELT

GENERAL ARRANGEMENT DETAIL .. CONVEYOR BELT

CHUITNA RIVER CROSSING
CONVEYOR BELT

MOOSE CROSSING
CONVEYOR BELT
(TYPICAL 8 PLACES)

ARTIST'S ILLUSTRATION –
CONVEYOR SYSTEM DESIGN

Diamond Chuitna Environmental
Impact Statement

FIGURE 2–10

will also be determined through on-site inspections; the same criteria described above will be used. Crossings will be located where moose are most likely to cross the conveyor, i.e., riparian areas and ridgetops.

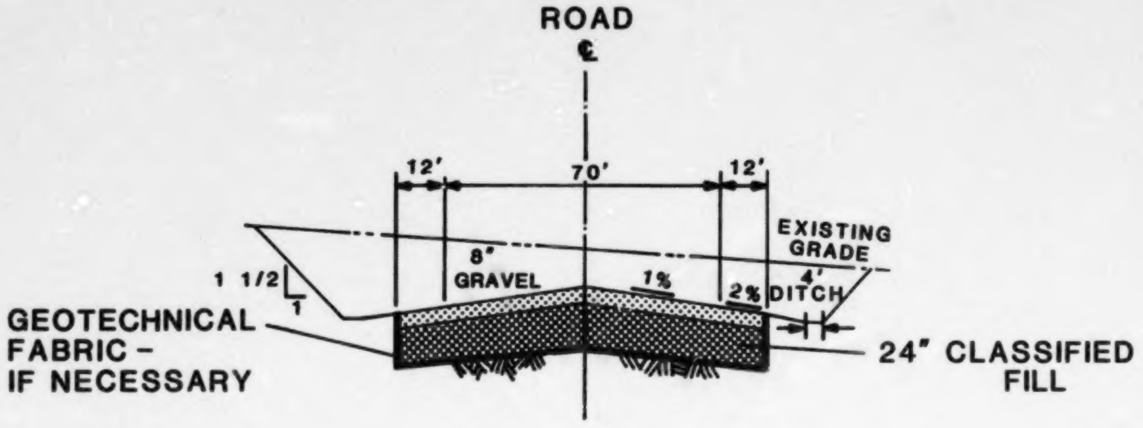
A light duty, minimally improved 4.6 m (15 ft) service/ access road suitable for four-wheel drive vehicles would be built immediately adjacent to the conveyor for maintenance purposes. It would be separated from the substantially improved access haul road primarily for safety reasons (to reduce risk of vehicle/conveyor collisions). The separation will also provide a greenbelt between the more heavily traveled access/haul road and the conveyor to increase ease of big game movements across the corridor. Drainage and sediment control measures for the conveyor will be the same as those described below for the main access/haul road. Brush within the conveyor right-of-way will be mechanically controlled; no herbicides will be used.

2.4.2 Access/Haul Road

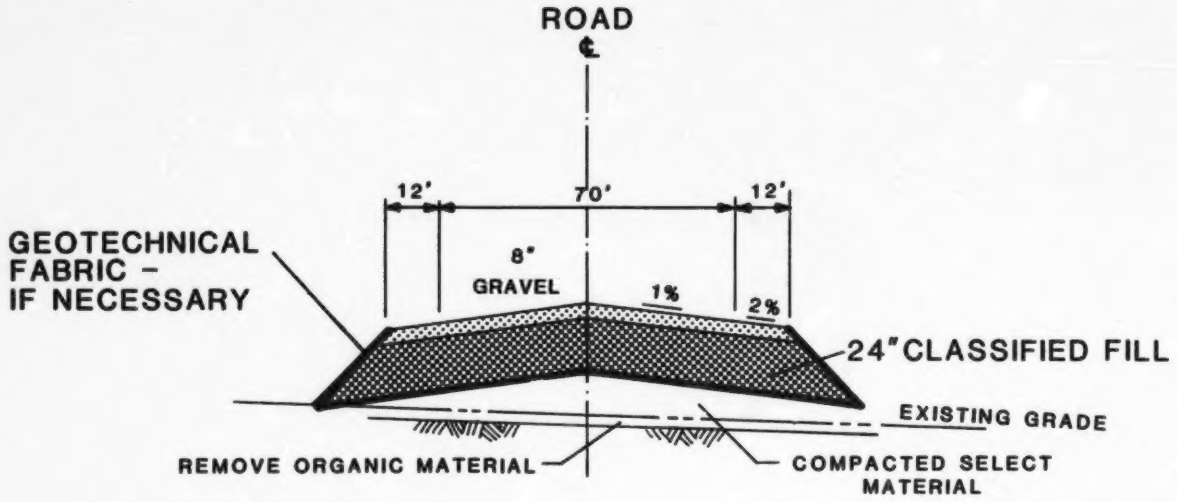
Regardless of which transportation corridor is selected, a private, all-weather access haul road would be constructed that would generally parallel the conveyor along that route (Figs. 2-7 and 2-8). The road would be gravel-surfaced, crowned to promote drainage, and would have two traffic lanes and wide gravel shoulders on each side (Fig. 2-11). The proposed southern route would have a 29 m (96 ft) wide road while the proposed eastern and northern routes would have 9.2 m (30 ft) wide roads. In clearing the corridor for the roads, an average prism of 35 m (116 ft) for the southern route and 12 m (40 ft) for either the eastern or northern routes would be cleared. Grades would be maintained at a maximum of 6 percent.

Over most of its length, the road would be separated from the conveyor by approximately 61 m (200 ft). At river crossings or other natural features, the road would have an independent alignment to maintain grade.

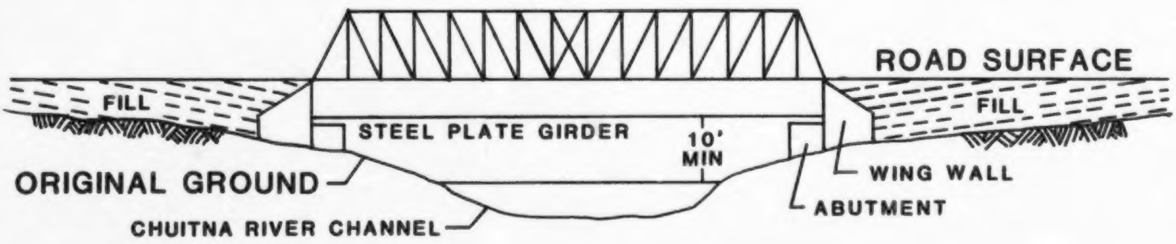
Drainage and sediment control measures will include: (1) construction of ditches to divert runoff from undisturbed areas around operational areas; (2) construction of collection ditches; (3) installation of culverts under roads to collect and control runoff from road surfaces, embankments, and adjacent areas; (4) surfacing of main roads and facility areas with gravel material; (5) revegetation of road cuts, embankments and other disturbed areas as soon as possible after construction; and (6) use of specific localized sediment control measures in sensitive areas. In sensitive areas such


ROAD
℄
12'
70'
12'
EXISTING GRADE
8" GRAVEL
1%
2%
4' DITCH
1 1/2
1
GEOTECHNICAL FABRIC - IF NECESSARY
24" CLASSIFIED FILL

CUT SECTION


ROAD
℄
12'
70'
12'
GEOTECHNICAL FABRIC - IF NECESSARY
8" GRAVEL
1%
2%
24"CLASSIFIED FILL
EXISTING GRADE
REMOVE ORGANIC MATERIAL
COMPACTED SELECT MATERIAL

FILL SECTION


ROAD SURFACE
FILL
FILL
STEEL PLATE GIRDER
10' MIN
ORIGINAL GROUND
WING WALL
ABUTMENT
CHUITNA RIVER CHANNEL

SOURCE: DIAMOND ALASKA COAL CO.

TYPICAL HAUL ROAD AND BRIDGE DESIGN

Diamond Chuitna Environmental Impact Statement

FIGURE 2-11

as those adjacent to stream channels, localized sediment control measures will include ditches with rock filter dams, gradient terraces with dugout filter ponds, rock drainageways, placement of sediment filter fabric, and use of straw or vegetative sediment filters as appropriate.

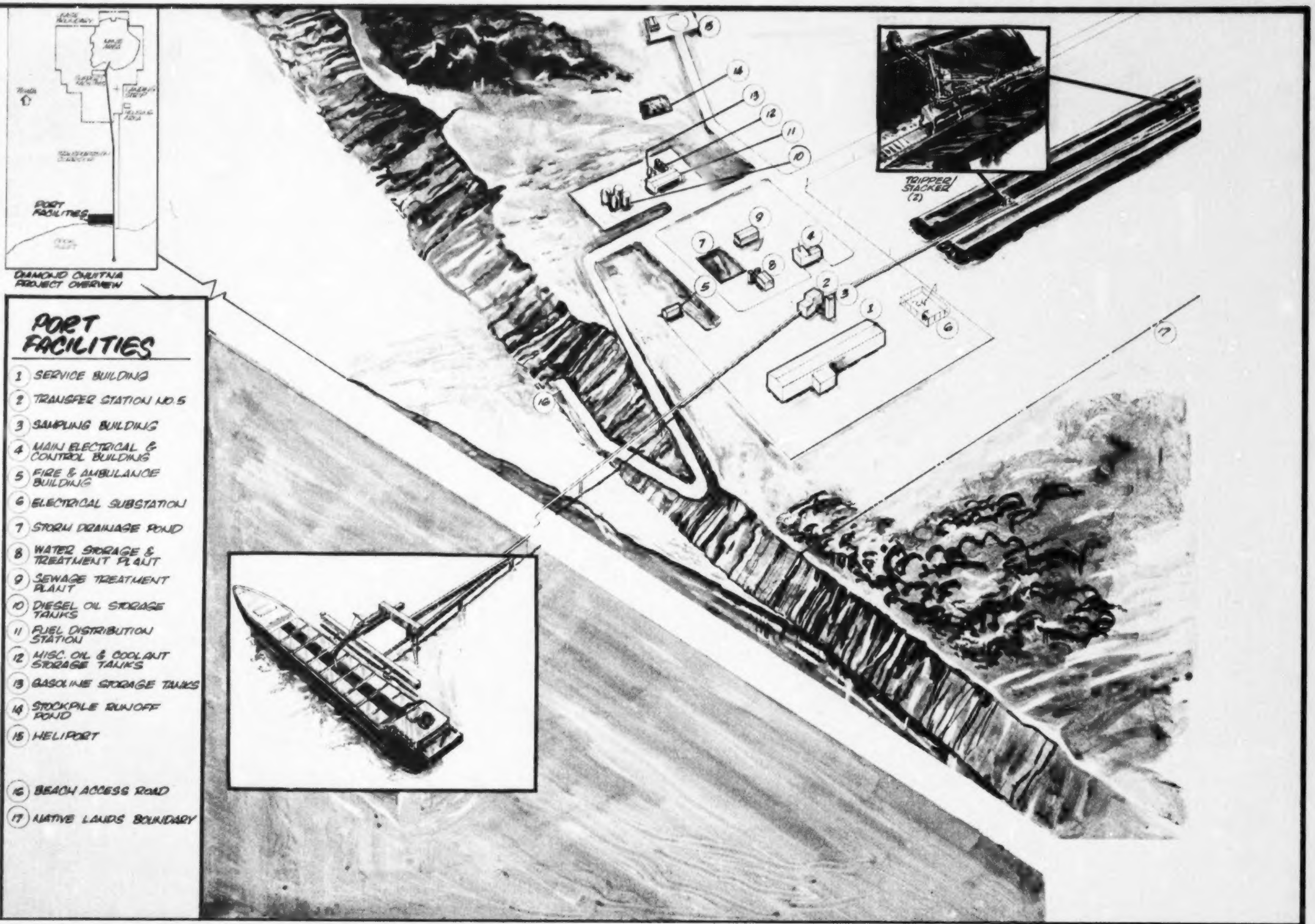
2.5 PORT FACILITIES

2.5.1 Onshore Port Facilities

The onshore port facilities which would be developed at either Ladd or Granite Point would ultimately be capable of accommodating an annual capacity of 10.9 million Mt (12 million short tons) of coal (Fig. 2-1). Either onshore site would occupy approximately 121 ha (300 ac) on the bluff above Cook Inlet. The site would be connected to a supply barge staging area at tidewater about 30 m (100 ft) below the bluff by a 7.3 m (24 ft) wide beach access road. Figure 2-12 is an artist's illustration of the port facilities if built at Granite Point. A facility at Ladd would be similar.

Major facilities at the onshore site would include a large service building, coal transfer station, sampling building (to sample coal heating value, moisture, ash and sulfur content), main electrical and control building, fire and ambulance building, electrical substation, water storage and treatment plant, sewage treatment plant, diesel fuel and gasoline storage and distribution area, and a heliport. The site will be fenced to minimize human/wildlife encounters. No one will be housed at the port site during project operations.

Coal would enter the onshore port facility on the overland conveyor and be transferred to one of the two 1.8 m (72 in) yard conveyors. It would then be sent directly to the shiploader on the approach trestle if a barge or ship were being loaded. If loading were not in progress, coal would be stored in two large parallel stockpiles on either side of the conveyor (Fig. 2-12). The amount of coal stored at the port site would vary depending upon shipping schedules, marine weather conditions, and downtime in mining operations. At full production, up to 1.1 million Mt (1.2 million short tons) of coal could be stored, but a minimum of 90,720 Mt (100,000 short tons) always would be stockpiled. A 30 to 45 day turnover of coal in the stockpiles would be anticipated. Tests on the self-heating potential of the coal indicated no susceptibility to fire hazard while exposed to the atmosphere. The coal piles will be unlined and will sit upon a gravel fill pad. Alignment of the piles will be approximately north-south at Granite Point to minimize contact with the prevailing winds. Alignment at Ladd has not yet been determined, but


PORT FACILITIES
DIAMOND CHUITNA PROJECT OVERVIEW
PORT FACILITIES
1 SERVICE BUILDING
2 TRANSFER STATION NO.5
3 SAMPLING BUILDING
4 MAIN ELECTRICAL & CONTROL BUILDING
5 FIRE & AMBULANCE BUILDING
6 ELECTRICAL SUBSTATION
7 STORM DRAINAGE POND
8 WATER STORAGE & TREATMENT PLANT
9 SEWAGE TREATMENT PLANT
10 DIESEL OIL STORAGE TANKS
11 FUEL DISTRIBUTION STATION
12 MISC. OIL & COOLANT STORAGE TANKS
13 GASOLINE STORAGE TANKS
14 STOCKPILE RUNOFF POND
15 HELIPORT
16 BEACH ACCESS ROAD
17 NATIVE LANDS BOUNDARY
TRIPPER/ STACKER (2)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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17

ARTIST'S ILLUSTRATION - PORT SITE FACILITIES

Diamond Chuitna Environmental Impact Statement

FIGURE 2- 12

stockpiles will also be aligned to minimize wind contact. The maximum dimensions of these stockpiles would be approximately 945 m (3,100 ft) by 61 m (200 ft) by 15 m (50 ft) high. During barge- or shiploading, coal would be taken from these stockpiles and placed on the conveyors to the approach trestle.

Coal would be transferred from the conveyor to the stockpiles, or taken from the stockpiles and placed onto the conveyor, by two large railmounted stacker-reclaimer units which would move parallel to the conveyor. These machines would have a bucketwheel at the end of their booms which would be able to break through a frozen crust of coal up to 0.6 m (2 ft) thick when reclaiming coal for shiploading.

A packaged commercial sewage treatment plant will be used to treat all sewage generated at the port facility. Following treatment to meet applicable standards, the effluent will be carried by pipeline along the elevated trestle and discharged into Cook Inlet at Granite Point or discharged into an onsite leach field at Ladd.

Nonorganic solid wastes will be deposited in fenced and enclosed dumpsters located throughout the port facility and collected on a regular basis. Initially, these wastes will be hauled to a temporary fenced landfill near the mine site which will be closed following completion of construction. For the first five to ten years of project operation, these wastes will be buried in a fenced landfill near the port facility. After that, the wastes will be hauled to the large permanent landfill in the vicinity of the mine. Solid wastes will not be put into the mine pit itself. Organic wastes will be deposited in separate fenced and enclosed dumpsters within the port facility and hauled to the housing area organic waste incinerator. Hazardous wastes will be handled completely separately and will be removed from the project area entirely for disposal at an authorized hazardous waste site.

Drainage and sediment control will be accomplished by drainage ditches which will collect all surface runoff from the disturbed area of the port site and divert it into sediment ponds. This will include storm runoff and water sprayed on coal stockpiles for dust control. Treatment methods will vary depending upon the water quality of the runoff. Following treatment, the water will be carried by pipeline on the approach trestle for discharge directly into Cook Inlet. All discharges will meet state and federal water quality standards (see the proposed final NPDES permit - Appendix D). The drainage and treatment system will be designed to accommodate volumes from the 10-year, 24-hour precipitation event. Likewise, all culverts and diversion ditches will be designed to contain the peak flow from a 10-year, 24-hour event.

2.5.2 Offshore Port Facilities

If full production is anticipated, a port could be developed at either Granite Point or Ladd. At either location, a trestle could be built to the deep water needed for accommodation of large coal ships. For less than full production, coal would be loaded onto ocean-going barges. Barges can operate in shallower waters than can the coal ships. Appropriate depths can be reached substantially closer to shore at Ladd than at Granite Point; therefore, if bargeloading only is required, a port would be developed at Ladd.

Offshore facilities for either port location would consist of an approach trestle with ship breasting and mooring dolphins (Fig. 2-12). The trestle length at Granite Point would be either 2,277 m (7,470 ft) or 3,810 m (12,500 ft) depending on the size of the ships which would be used.

Approximately 287 m (940 ft) of either trestle would be upland of the mean high tide line, thus reducing the length of the trestle extending into the inlet. The trestle would be 7.9 m (26 ft) wide, 9.1 m (30 ft) high and supported by single piles up to 3.7 m (12 ft) in diameter. The piles would be approximately 122 m (400 ft) apart and the trestle would be a minimum of 6.1 m (20 ft) vertically above the water at mean higher high water (MHHW). The structure would be designed to withstand the greater than 9.1 m (30 ft) tides, 3.6 m/s (7 knot) currents and 1.1 m (42 in) thick ice floes of upper Cook Inlet. One of the mooring dolphins would support a helipad.

At Granite Point, smaller "Panamax class" vessels (54,432 to 72,576 Mt [60,000 to 80,000 dwt]) with drafts of 11.9 m (39 ft) capable of passing through the Panama Canal could be loaded at the shorter trestle with a berthing depth of 14 m (45 ft) at mean lower low water (MLLW). Larger vessels up to 108,864 Mt (120,000 dwt) would require the longer trestle with a berthing depth of between 15.2 and 18.2 m (50 and 60 ft).

At Ladd, to accommodate lower production levels, the 9,072 to 13,609 Mt (10,000 to 15,000 dwt) barges would require a trestle of approximately 168 m (550 ft) in length to reach a berthing depth of 1.2 m (4 ft) at MLLW. This would require tidally controlled berthing where barges would be moved into the dock, loaded and then moved away to take advantage of water depths at higher tide levels. At full production, the trestle would be approximately 3,505 m (11,500 ft) long to load large ships at a berthing depth up to 18.2 m (60 ft). The trestle specifications would be the same as described above for Granite Point.

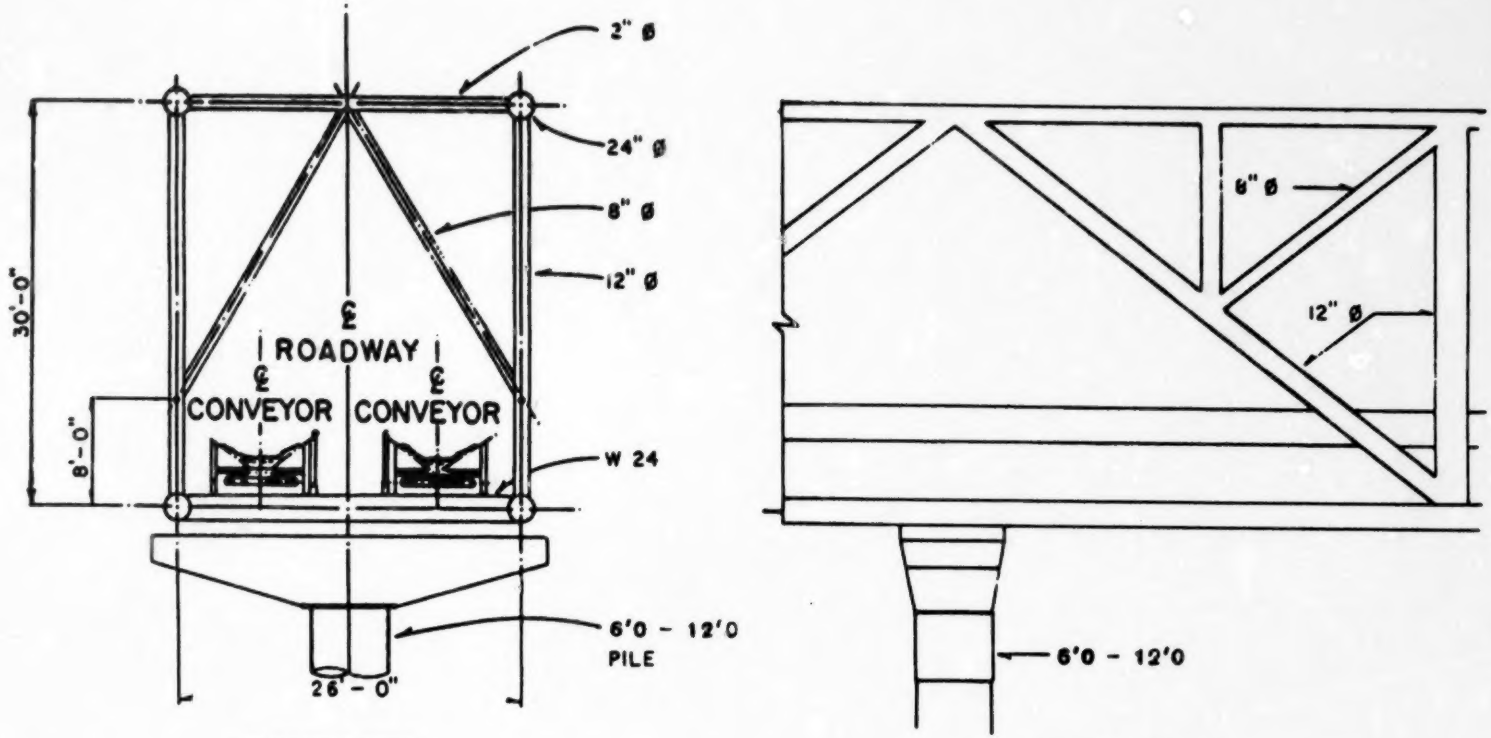
Coal would be transported from the onshore port to a linear shiploader facility at the end of the approach trestle on two covered conveyors each 1.8 m (72 in) wide (Fig. 2-13). At full production, the shiploader would have an effective loading rate of 3,629 to 4,536 Mt (4,000 to 5,000 short tons) per hour. It would have a boom capable of swinging to reach all compartments of a coal barge or ship, with the spout being lowered into the hold to reduce dust generation. The trestle conveyors would be paralleled by a 1.5 m (5 ft) wide walkway that would be used to transport operating and maintenance personnel and equipment. Coal could be loaded 24 hours per day throughout the year, affected only by weather and ice conditions in Cook Inlet.

The trestle will not be used for receiving supplies for the project. Freight, bulk materials, small quantities of certain fuels and other supplies will be brought in by barge, unloaded at the barge staging area on the beach, and trucked up the beach access road (Fig. 2-12) to the onshore port facility, housing site or the mine area as required. Major quantities of diesel fuel and gasoline will arrive by tanker and be pumped through a pipeline supported by the elevated trestle to the onshore port facility. Fuel will be stored in tanks at the onshore port site (which will hold a four-month supply) and be trucked by tractor/trailer units to the housing site or mine area as required (see Sect. 2.10.3). When ice conditions prohibit use of barges, food and miscellaneous supplies will be transported to the project area by aircraft.

2.6 HOUSING AND AIRPORT FACILITIES

2.6.1 Housing

The workforce would be housed in permanent single-status housing and community facilities on an 8 ha (20 ac) site. The entire housing area will be fenced to minimize human/animal contacts. Full production facilities would consist of four buildings with 102 units and two buildings with 66 units connected by all-weather corridors. Other facilities would include a dining hall/administration building, recreation center, laundry, medical facilities, security and fire services, and a maintenance building (Fig. 2-14). The facilities would be operated on the "motel" concept with employees checking into available rooms for their four-day stay at the project site. There would be no town at the housing site. The facilities would be designed for the actual number of employees on site (424) with a 27 percent contingency for weather conditions for a total of 540 beds. No employee-owned firearms or alcohol will be allowed at the housing facilities.


2" Ø
24" Ø
8" Ø
12" Ø
W 24
6'0 - 12'0
PILE
26' - 0"
30'-0"
8'-0"
℄
ROADWAY
℄
CONVEYOR
℄
CONVEYOR
6" Ø
12" Ø
6'0 - 12'0

FRONT VIEW

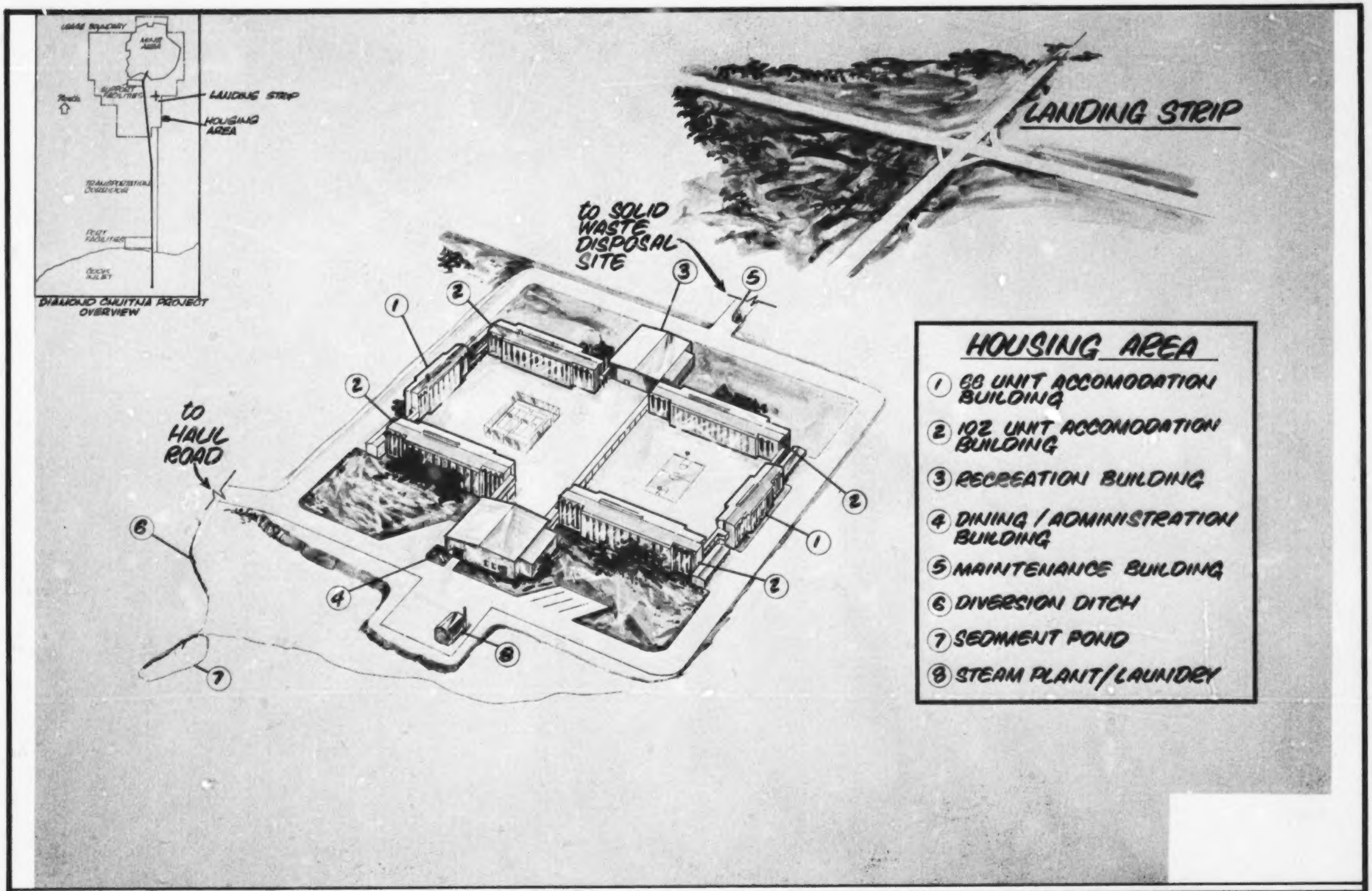
RIGHT VIEW

SOURCE: Diamond Alaska Coal Company

TRESTLE AND PIER DESIGN

Diamond Chuitna Environmental Impact Statement

FIGURE 2-13


LEASE BOUNDARY
MINE AREA
SUPPORT FACILITIES
North
LANDING STRIP
HOUSING AREA
TRANSPORTATION CORRIDOR
PORT FACILITIES
COOK INLET
DIAMOND CHUITNA PROJECT OVERVIEW
LANDING STRIP
to SOLID WASTE DISPOSAL SITE
to HAUL ROAD
HOUSING AREA
① 68 UNIT ACCOMODATION BUILDING
② 102 UNIT ACCOMODATION BUILDING
③ RECREATION BUILDING
④ DINING / ADMINISTRATION BUILDING
⑤ MAINTENANCE BUILDING
⑥ DIVERSION DITCH
⑦ SEDIMENT POND
⑧ STEAM PLANT/LAUNDRY
①
②
③
④
⑤
⑥
⑦
⑧

ARTIST'S ILLUSTRATION –
HOUSING AND AIRSTRIP FACILITIES

Diamond Chuitna Environmental
Impact Statement

FIGURE 2– 14

Water will be obtained from a series of ground-water wells with a storage capacity of approximately 302,800 l (80,000 gal) at the site. A packaged commercial sewage treatment plant with a capacity of approximately 136,800 l (30,000 gal) per day will handle sanitary and other drainage from the housing complex. Treatment will be at primary and secondary levels. Effluent from the Lone Creek housing area will be carried in a pipeline and discharged into the Chuitna River directly south of the housing site. Effluent discharge from the Threemile and Congahbuna housing sites has not been designed but will conform to state and federal regulations. The sludge effluent generated from treatment plants at any housing site will be hauled to the mine pit for burial.

Disposal of all wastes will be in approved sites. Nonorganic solid wastes will be deposited in fenced and enclosed dumpsters located throughout the housing area and collected on a regular basis. Initially, these wastes will be hauled to a temporary fenced landfill near the mine site which will be closed following completion of construction. For the first five to ten years of project operation, these wastes will be buried in a fenced landfill near the housing area. After that, the wastes will be hauled to the large permanent landfill in the vicinity of the mine. Solid wastes will not be put into the mine pit itself. Organic wastes will be deposited in separate fenced and enclosed dumpsters within the housing area and burned in a nearby incinerator. Hazardous wastes will be handled completely separately and will be removed from the project area entirely for disposal at an authorized hazardous waste site.

Drainage and sediment control will be handled by a ditch collecting system which will surround the facility and collect surface runoff and carry it to two sediment ponds for treatment and release to existing drainages. Treatment methods will be the same as for the mine service area and port site facilities, and water quality standards will be met before discharge.

2.6.2 Airstrip

A private gravel landing strip would be located close to the housing facility (Fig. 2-2). The main runway, 1,524 m (5,000 ft) long and 30 m (100 ft) wide, would be oriented in a north-south direction with a smaller 914 m (3,000 ft) east-west runway. The airstrip would have navigation lights, but would not be capable of handling instrument approaches in bad weather. A small terminal building and a maintenance building would be located at the site. Water requirements will be small and water will be hauled to the terminal building by truck. Chemical toilets will be used with sewage being hauled and dumped into the housing facilities' treatment plant. Gray water from the terminal will be treated to meet water quality standards and then released into the airstrip's drainage system which will discharge to existing drainages. There will be no sediment ponds. Solid wastes will be kept in an enclosed, fenced dumpster which will be regularly emptied and disposed of in the same manner as that for the housing area.

2.7 POWER GENERATION

Estimated average-load electrical power demands for the project at full operation would be approximately 35 Mw, with a maximum demand of 50 Mw. Power would be purchased from the existing Chugach Electric Association natural gas power station at Beluga (Fig. 2-1) and transported to the project site by a 69 kv line on wooden poles. If the Granite Point port site were selected, the powerline would follow the existing powerline right-of-way running from the power plant to the oil tank farm about 2.4 km (1.5 mi) west of the proposed Granite Point port site (Fig. 2-1). This existing right-of-way would not have to be widened and would connect with a wooden pole transmission line within the transportation corridor between the port site and the mine.

If the Ladd port site were selected, the powerline would follow the existing right-of-way until it intersected the transportation corridor where it would split to provide power to both the port site and the mine.

2.8 RECLAMATION PLAN

The discussion below summarizes the major aspects of the proposed reclamation plan. References are given to the location of more detailed information in the state surface mine permit application (Diamond Alaska Coal Company 1985).

2.8.1 Mine Pit

The reclamation plan for the mine area will have short-term as well as long-term goals. The short-term goal will be the immediate stabilization of the disturbed site through control of erosion and sedimentation. The long-term goals will be to: 1) establish wildlife habitat that will be at least as useful and productive as the premining environment; and 2) create an aesthetically acceptable site that blends with the surrounding terrain and vegetation. These goals will be met using the methods described below.

During the initial 10 years of operation, a total area of approximately 583 ha (1,440 ac) would be mined. Reclamation of disturbed sites will begin during the second year of mining (year five of the permit) and will follow, but not interrupt, mining annually until all acreage disturbed by mining and associated activities is reclaimed. No disturbed acreage will be unclaimed.

During the first year of reclamation, 1 ha (3 ac) will be reclaimed. During the next five years, 51 ha (125 ac), 56 ha (139 ac), 143 ha (354 ac), 61 ha (151 ac) and 75 ha (186 ac) will be reclaimed, respectively, for a total of 387 ha (958 ac) reclaimed after six years of mining. More detailed information may be found in Vol. XVI, Sec. 4.08, of the permit application.

2.8.1.1 Backfilling and Grading

After the initial box cuts have opened the pits for mining operations, the overburden and interburden material from the active mine areas will be backfilled by draglines and truck and shovel operations into the mined out areas (Fig. 2-3). Grading and stabilization then will be done by bulldozers and graders. The final topography will match the premining contours as closely as possible and will not exceed original slope grades. Slopes will be designed to minimize erosion and maintain adequate water retention for vegetative growth. Gradient terraces will be used to control sheet runoff.

Postmining surface drainage channels will be located to minimize erosion and slumping. Major reconstructed surface drainage channels will be lined with riprap material as necessary to limit bank erosion and scour. The drainages will be reconstructed with gradients, meanders, and habitats similar to premining drainages to provide habitat for anadromous fish species.

No exposed coal seams will be left on the reclaimed surfaces. A minimum of 1.2 m (4 ft) of nontoxic and noncombustible spoil material will be used to cover any exposed seams that remained after mining. Spoil materials at the mine site contain no known acid-forming or toxic substances; therefore, no special handling techniques for these types of materials are anticipated.

2.8.1.2 Topsoil Handling Plan

Suitable topsoil material will be recovered from areas to be affected by mining and related operations prior to disturbance. The recovered topsoil will be either stock-piled for later use or redistributed directly on backfilled and graded areas. When possible, the topsoil will be immediately redistributed in preference to stockpiling. Topsoil removal, stockpiling, and replacement will be scheduled to coincide with the overall mining sequence.

Stockpiles will be designed to minimize wind and water erosion, and topsoil will not be disturbed or rehandled after stabilization unless the soil were to be redistributed on a graded surface. Unnecessary compaction and contamination of stockpiles will be eliminated and they will be protected from waste disposal, construction, and other such disturbances to maintain integrity. All stockpiles will be located within the mining limit and will be as small as possible.

Planting specifications to control stockpile erosion will differ depending on the life of the stockpile. Stockpiles remaining in place less than 30 days during the growing season will not be revegetated but will be left in roughened condition to retard erosion. Stockpiles remaining in place longer than 30 days during the growing season, but less than one calendar year, will be seeded with an annual seed mixture. Stockpiles to remain in place over one growing season and into or through additional growing seasons will be seeded with a permanent grass mixture and mulched.

Topsoil will be redistributed in a manner and at such time that: (1) achieves an average soil thickness of 15.2 cm (6 in) consistent with the revegetation goals, contours, and surface drainage systems; (2) minimizes compaction, contamination, and erosion; (3) conserves soil moisture and promotes revegetation; and (4) minimizes deterioration of the biological, chemical, and physical properties of the soil.

Following replacement and final grading of topsoil, but before seeding, a sampling plan will be implemented to evaluate the preparation of backfill and seedbed materials. This plan will include analysis of samples by a designated analytical laboratory.

Peat will be salvaged in advance of mining operations for recreating peat-filled wetland habitats on regraded soils. To the extent possible, stockpiling of peat will be avoided and no long-term (greater than 30 days) stockpiles will be established. Temporary peat stockpiles will remain isolated from topsoil stockpiles and will not be sited in drainage ways. More detailed information may be found on Vol. XVI, Sec. 4.10, of the permit application.

2.8.1.3 Revegetation

To determine which plant species will be used for revegetation, certain criteria were established:

- Native species will be used wherever possible.
- Seed mixtures and planting rates will reflect consideration of the relationship between herbaceous species and woody species in terms of competition for soil moisture, nutrients, and sunlight. For example, heavy seeding rates of vigorous, introduced grass species were considered inadvisable because of undesirable competition with wood species.

- Wildlife value will be a prime consideration in the selection of plant species and development of seeding and planting rates.

With the above goals in mind, preliminary seed mixtures and stocking selections were developed based on species characteristics, potential success, commercial availability, and availability of seed or cuttings stock on or near the permit area.

As soon as practicable after a disturbed area is returned to the proper contour and grade, topsoil will be spread and the site will be stabilized. Erosion and sedimentation will be minimized by construction of sediment control and retention structures, proper seedbed preparation, fertilization, and planting of rapidly establishing species. The longer-term goals of establishing productive wildlife habitat will be accomplished through additional planting of seedlings and cuttings of woody species.

Sediment ponds and associated diversion ditches will be removed at the completion of mining when the upstream drainage areas are stabilized, revegetation standards met, and acceptable water quality attained. Prior to regrading, ponds will be dewatered and the sediment material tested for toxicity. If unsuitable for use in the revegetation program, the material will be removed and buried under 1.2 m (4 ft) of nontoxic fill. Sediments should be stable in the landfill. No additional undue leaching should occur. Remaining ponds and associated drainage ditches will then be backfilled, graded, and revegetated. More detailed information may be found in Vol. XVI, Sec. 4.11 of the permit application.

2.8.2 Overburden Stockpile

The size, shape, and slope of the overburden stockpile will be such that stability will be assured once vegetation is established. Though the topography of the stockpile will differ from the surface of the mined areas, slope angles will permit the use of agricultural equipment. Thus, the techniques described above for the mine area will also be used on the stockpile. Once a portion of the surface is no longer disturbed by stockpiling activities, revegetation will be completed during the next planting season using the same procedures described in Section 2.8.1.3.

2.8.3 Mine Service Area

All steel and fabricated buildings will be dismantled and removed for salvage. Structures and equipment of no salvage value will be buried in the mine pit. Other components, including concrete footings, slabs, and foundations will be removed at ground level before being buried in the pit. Gravel pad and road surfacing materials and all coal debris will also be disposed of in the mine pit. Sedimentation ponds and associated drainage ditches will be reclaimed as described for the mine pit area.

Once cleared, all excavations at the site will be filled and the site graded to the approved postmining topography. Areas exhibiting compaction detrimental to plant establishment will be ripped. Revegetation will be done in the same manner as described for the mine pit area.

2.8.4 Transportation Corridor

Any transportation facilities which cannot be beneficially used for other purposes will be dismantled and salvaged. Any facilities not salvaged will be removed, foundation structures broken up, and the resulting rubble buried in an approved landfill. Disturbance to the land under the conveyor will be limited to a denuding of the ground surface where poles and conveyor braces had been located. These disturbed areas will be revegetated where more than 50 percent of the predisturbance vegetative cover has been eliminated.

If the main haul road is not left intact for other users, road surfacing and culvert materials will be removed and buried in an approved landfill. The road bed will be ripped to relieve compaction and the roadbed and embankments will be graded to blend with adjacent undisturbed terrain. Temporary drainage features will be built to control runoff and erosion until revegetation of regraded areas occurs.

2.8.5 Port Site

Structures which would serve a useful purpose for continued activities will be left in place. The trestle might serve future coal mining or other mineral or natural resource development operations in the region. The facilities might also provide a source of revenue for other future businesses. In any event, all facilities which will not be retained for other beneficial uses will be appropriately reclaimed and the disturbed areas revegetated in the same manner as described above for the mine service area facilities. Instead of using the mine pit, any burial would take place in approved landfills.

2.8.6 Housing Area and Airstrip

All improvements will be dismantled and removed for salvage value. Foundations, roads, gravel pads, etc., will be appropriately reclaimed and the disturbed area revegetated as described above for the mine service area facilities. If the State does not want the airstrip to remain usable, it will be reclaimed and revegetated also.

2.8.7 Fish Resources

Several types of mitigation will be accomplished to protect fish resources during the development and operation of the mine. Measures include construction and operation procedures, monitoring studies, and a restoration plan. Table 2-1 outlines the major proposed fish mitigation measures and associated monitoring programs. More detailed information may be found in Vol. XV, Sec. 4.07.1 of the ASMCRA permit application; ASMCRA requirements are summarized in Chapter 6.0 of this document.

2.9 CONSTRUCTION

2.9.1 Schedule and Sequence

Once project construction is begun, it would take approximately three years to complete. Most construction would take place each year during the May through October period.

2.9.1.1 First Year

The first step would be establishment of a barge staging area at the base of the bluff below the port site (Fig. 2-12) and construction of a road up the bluff to the onshore port facilities site. The onshore port site would serve as the main construction camp and would have housing and dining facilities, construction offices, fuel tanks, sewage treatment plant, and temporary equipment service, repair and warehousing facilities. Vegetation clearing and grubbing would begin at the port site in preparation for the major civil work to be completed in the second year.

Because of its importance in development of the project, construction of the mine access/haul road would begin as soon as the initial facilities were established at the port site. Regardless of which port site were chosen, road construction equipment would be landed at the existing Ladd beach barge site and transported over the existing Ladd road to the mine area so road construction could be simultaneously carried out from both ends. Completion of the road would take about 18 months.

TABLE 2-1

MAJOR PROPOSED FISH MITIGATION MEASURES AND MONITORING PROGRAMS DURING FIRST TEN YEARS OF PROJECT

IMPACT	MITIGATION	MONITORING
1) Increased sedimentation due to mining	A - Construct settling ponds designed to catch mine dewatering until sediment settles out.	NPDES permit compliance.
	B - Whenever possible, minimize use of construction and mining in streams other than those designated for mining.	Environmental coordinator would periodically check construction and mining areas for compliance.
	C - Prior to the construction of settling ponds, no mining in streams would occur during spawning periods of salmon species potentially using the mainstem section of watershed 2003.	Environmental coordinator would monitor construction activities to ensure compliance.
2) Habitat loss due to mining in streams	A - Rebuild sections of tributaries 200304 and 200305 to approximate premining conditions as much as possible.	Conduct fish habitat characterization studies once after restoration in order to determine value of streams in terms of potential fish use.
	B - Revegetate mined areas to minimize increased erosion rates and loss of overhanging vegetation in vicinity of streams.	Environmental coordinator would monitor revegetation efforts to determine program effectiveness.
3) Habitat loss due to altered flows in streams	A - Return water form sediment ponds into lower sections of tributary 200305 and 200304 and mainstem portions of watersheds 2003 and 2002.	Conduct an instream flow survey at stream location(s) exhibiting potential significant losses of salmon habitat. Survey would be conducted once after mined stream segments were restored.
4) Increased sedimentation and habitat alteration due to conveyor system and road crossing watershed 2003	A - Staging areas for stream crossings would be located outside of riparian zone to minimize amount of sediment entering stream and reduce disturbance to riparian vegetation and aquatic habitats.	Environmental coordinator would inspect stream crossing activity for compliance.
	B - A maximum ROW of 30 m (100 ft) would be used at the stream crossing to reduce disturbance.	Environmental coordinator would inspect design plans and construction activities.

TABLE 2-1
MAJOR PROPOSED FISH MITIGATION MEASURES AND MONITORING PROGRAMS DURING FIRST TEN YEARS OF PROJECT
(continued)

IMPACT	MITIGATION	MONITORING
	C - Construction methods would employ latest state-of-the-art techniques. (Examples of bank and stream bottom protection measures would include riprapping, upland storage of excavated riverbed materials, importing clean backfill, backfilling with previously excavated riverbed materials, and revegetation.	Environmental coordinator would review proposed construction methods and make suggestions on bank and stream bottom protection measures at each crossing. After construction, the coordinator would inspect condition of stream bank and bottom substrate and other fish habitat characteristics at an immediately downstream of the proposed crossing.
	D - Road crossing would be constructed and maintained to prevent obstructions to movements of adult and juvenile salmon.	Environmental coordinator would inspect construction activities and make observations during different flow regimes.
	E - Construction activities would be scheduled to avoid spawning periods of salmon if possible.	Environmental coordinator would review construction timing plans and inspect construction activities.
5) Alter water quality due to mine dewatering and relase of water from settling ponds.	A - NPDES permit compliance.	NPDES permit compliance.
6) Fuel or lubricant spills	A - Fueling and lubrication of equipment would not occur within approximately 201 m (660 ft) of streams. Equipment would be properly maintained and checked for leaks periodically. Spills would be reported immediately to the environmental coordinator.	Environmental coordinator would approve fueling locations and routinely check for compliance. Affected streams would be immediately surveyed for fish kills following a spill.

Clearing, grubbing, site grading, and electrical distribution networking would be completed at the housing facilities site, and the dining hall, recreation center and about one-fourth of the housing units would be constructed. The airstrip would also be constructed and made operational.

2.9.1.2 Second Year

The major civil and building construction work would be completed at the onshore port site. Pilings for the offshore elevated trestle would be driven and the conveyors at the onshore port site would be built. The mine access haul road would be completed and additional housing units, the boiler plant and communication facilities would be constructed at the housing area.

At the mine service area, most civil work would be done and the electrical system completed. Limited building construction would be initiated. Construction of the water control and treatment facilities for the whole mine area would also begin.

2.9.1.3 Third Year

The offshore trestle would be assembled on the pilings and the shiploader erected. The stacker-reclaimer would be erected at the onshore port site and the remainder of the housing units would be completed.

At the mine service area, facilities construction would be completed. Clearing and grubbing would begin at the mine site with initial stripping of overburden beginning late in the third year or early in the fourth.

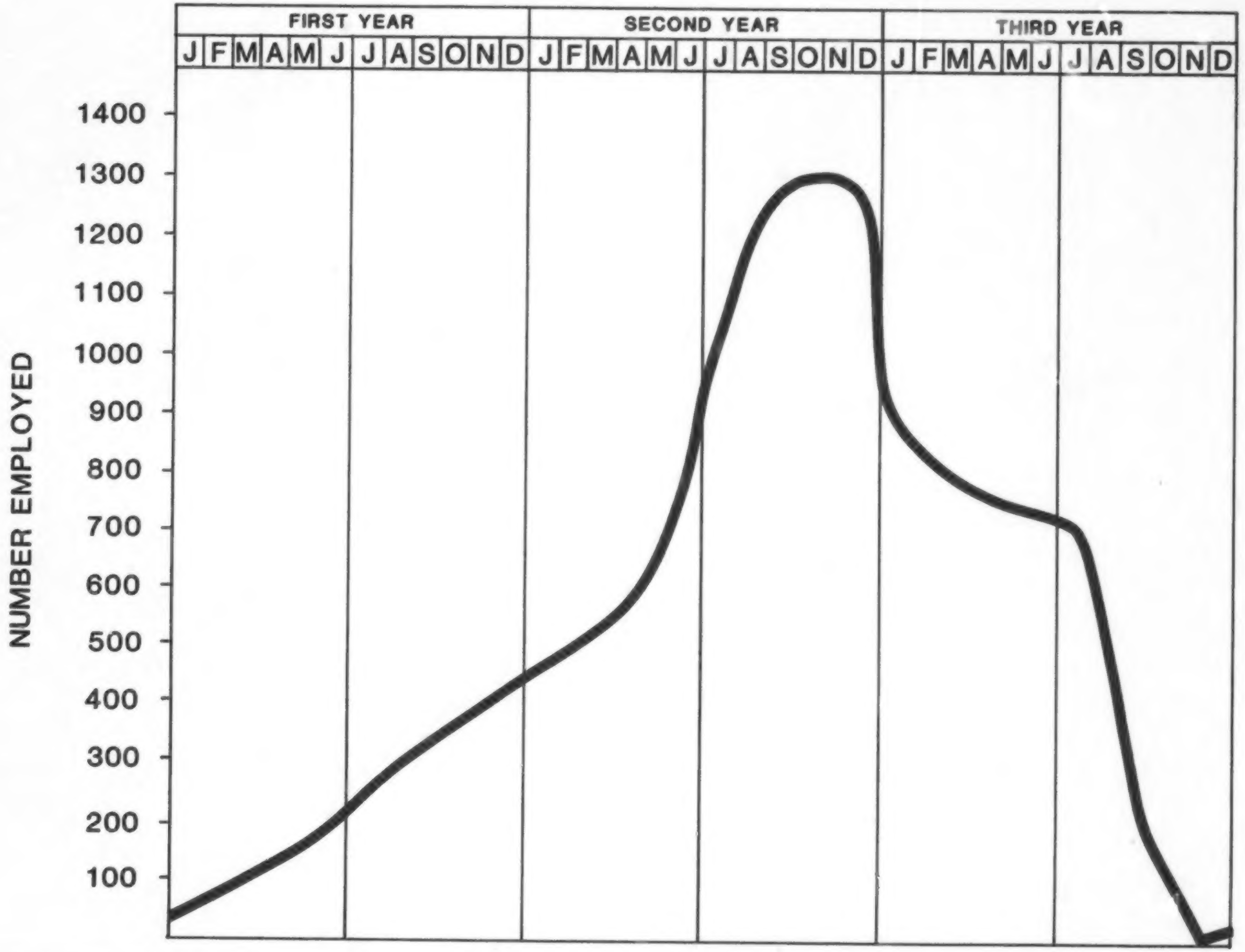
2.9.2 Construction Employment

The estimated number of workers to be employed during construction is shown in Figure 2-15. Construction employment would gradually increase to approximately 430 at the end of the first year, then rise quickly to a peak of about 1,300 workers in October and November of the second year. Employment would then decrease quickly to approximately 750 between March and July of the third year. By the end of the third year, construction employment would drop to well below 100 when production would begin.

2.9.3 Construction Methods

2.9.3.1 Facilities Sites

Construction methods for the three major facilities sites (the mine service area, onshore port site, and the housing area and airstrip) would be similar. Prior to actual construction, access roads to each facility would be



NUMBER OF WORKERS EMPLOYED, BY MONTH, DURING PROJECT CONSTRUCTION

Diamond Chuitna Environmental Impact Statement

FIGURE 2-15

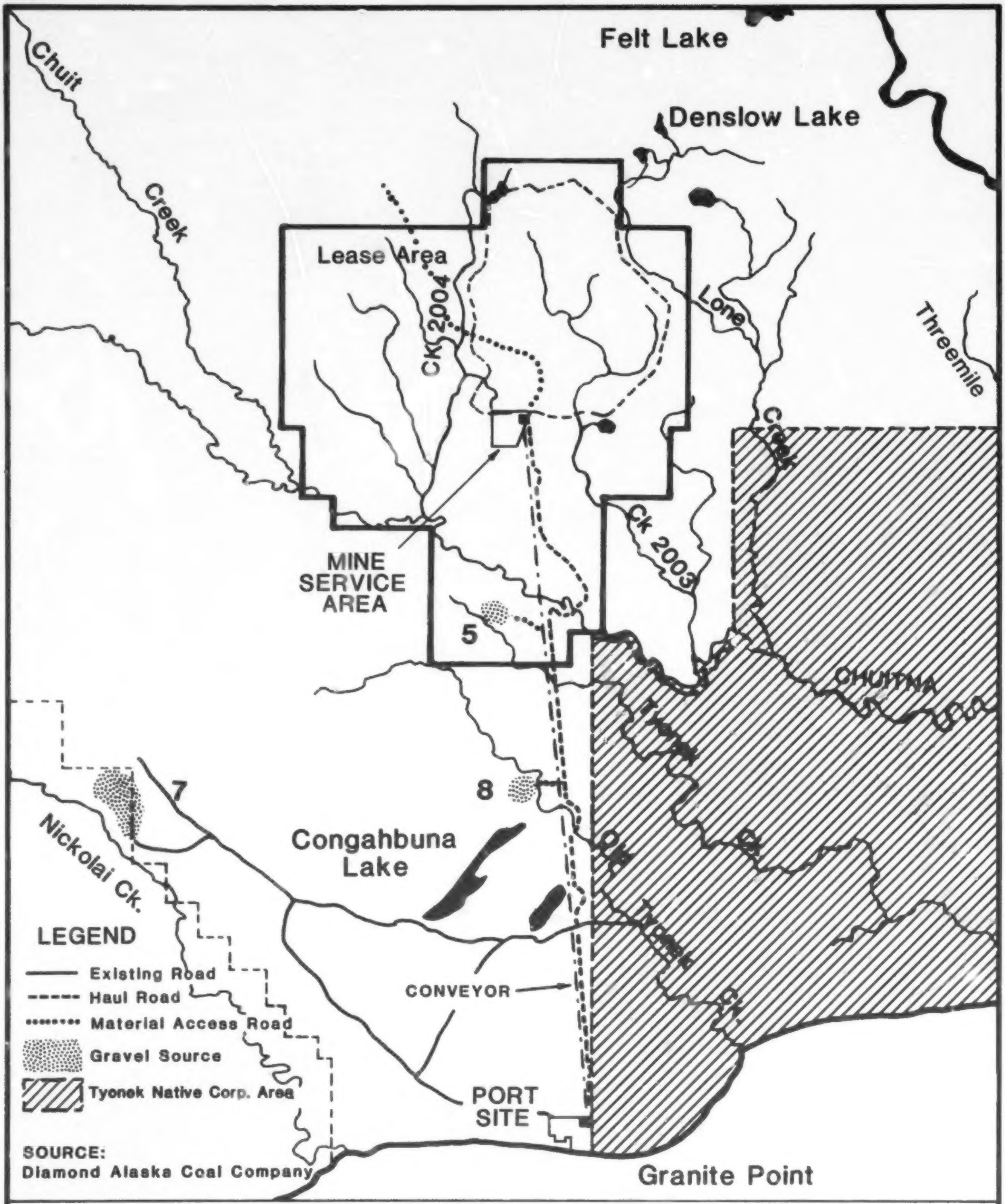
installed. In general, fabrication of most facilities would be completed at factory locations with the modules being shipped by barge to the port for offloading, transportation to the site, assembling, and erection.

Site work would begin at each facility with clearing and grubbing of all trees and brush. This material will be put into windrows for burning, if conditions allowed, or buried under an adequate depth of spoil in the mine pit if burning is not possible. Precautions will be taken to prevent beetle infestation of white spruce. Areas with peat or muskeg deposits will be drained by ditches to facilitate removal. The peat will be hauled to a nearby disposal site which will be revegetated after it has served its purpose. Diversion ditches and sediment ponds will be constructed around the perimeter of the facilities to control and treat water runoff. Ditch sizes and sedimentation control methods will be similar to those described below for the haul road. After the facility sites are "final" graded, the modules will be trucked to the sites and actual construction of the buildings and other facilities will begin.

All subgrade and final grade gravel material, including that used for construction of the conveyor and haul road, would come from the areas shown in Figure 2-16, if the southern corridor is utilized. Gravel sites along the northern corridor are indicated in Figure 2-8. Gravel sites for use along the eastern corridor have not been investigated. Approximately 3.82 million m^3 (5 million yd^3) of borrow* material would be used for all project facilities. Of this total, approximately 458,760 m^3 (600,000 yd^3) would be gravel and 3,058 m^3 (4,000 yd) would be riprap or armor rock. The remainder would be any suitable fill material.

The material sources will be accessed by two-lane gravel roads suitable for heavy equipment. They will be located to maximize use of the existing logging and oil exploration road systems in the project area. Prior to any activity at the material sites, small diversion ditches, and berms will be constructed around the perimeter to divert surface runoff away from the area. Vegetation within the material pit boundaries will be cleared and disposed of in the same manner as described above for the facility sites. All surface material will then be removed and stockpiled in a suitable nearby location. Erosion control measures, including temporary seeding, will be used as appropriate to stabilize the stockpiles.

In wet areas, sumps will be constructed at a low point on the pit bottom to collect water. Some small-scale blasting may be required to establish these drainage sumps. Small submersible pumps will be used to remove the water for discharge to the surface drainage system. Sediment fences,


Felt Lake
Denslow Lake
Chuit
Creek
Lease Area
Ck 2004
Lone
Creek
Threemile
Ck 2003
MINE
SERVICE
AREA
5
CHUITNA
Tyonek
Ck.
Old Tyonek
Ck.
7
8
Congahbuna
Lake
Nickolai Ck.
LEGEND
Existing Road
Haul Road
Material Access Road
Gravel Source
Tyonek Native Corp. Area
CONVEYOR
PORT
SITE
Granite Point

SOURCE:
Diamond Alaska Coal Company

GRAVEL SOURCE LOCATIONS, SOUTHERN CORRIDOR

Diamond Chuitna Environmental Impact Statement

FIGURE 2-16

fabric filters, and straw bale dikes will be used as needed to remove sediment from the pumped water as well as to control sediment in and around the pit.

A tracked-dozer will be used to rip material and a front-end loader will feed it into a crusher hopper. The crushed material will be screened and stockpiled by size in the pit area prior to being hauled by scrapers or rear-dump trucks to use areas. During construction of the project facilities, the crushing and screening operation will be continuous. Following construction, the operation will occur on an intermittent basis.

When a material source is exhausted or when operation is impractical due to low demand or haulage distance, an area will be reclaimed to a condition compatible with, and similar to, the surrounding terrain. The pit will be backsloped either through placement of the stockpiled overburden material or through ripping and dozing to provide a stable slope to minimize erosion and blend with surrounding terrain. Suitable surface material will be replaced in a uniform thickness over the disturbed area and erosion control measures will be taken including contour furrowing, terracing, and construction of rock drains. The entire area will then be revegetated using a suitable seed mix of indigenous and introduced species.

No dredging or filling will be necessary for either the trestle or berthing offshore port facilities. Each monopile will be driven with hammers to a predetermined depth in the inlet floor for support of the approach trestle, shiploader and berthing dolphins. Structural steel trusses will then be placed on top of the monopiles with barge-mounted cranes to serve as the platform to support the conveyors and shiploading equipment.

2.9.3.2 Conveyor and Access/Haul Road

Conveyor construction would occur in two phases. In the first phase, vegetation will be cleared from the right-of-way only to the extent necessary for construction access. Vegetation will be windrowed and burned under permits from DNR and DEC. Ground cover will be left intact where feasible to provide erosion protection. Runoff will be collected by diversion channels and routed to sediment control structures prior to discharge. Then, only limited cut and fill operations will be necessary since generally both the conveyor and its adjacent service road will follow the natural terrain. The rigidity of the conveyor structure and the inherent design flexibility will allow localized topographic features such as small drainage channels to be effectively bridged. Upon completion of site preparation work, the conveyor support piers will be placed. In phase two, mobile cranes will lift prefabricated conveyor framework sections into place for attachment to the support piers.

Construction of the access/haul road will require some cut and fill operations which will occur simultaneously with placement of culverts. Where the road crosses a surface drainage channel, culverts designed to pass the peak discharge from a 10-year, 24-hour precipitation event, with no ponding on the upstream end, will be used. All culverts will be placed on suitable bedding material and appropriate riprap material will be incorporated at the inlet and outlet to minimize erosion. "Trash rack" structures will be installed at culvert inlets to prevent clogging due to debris.

In areas where adverse surface conditions exist for building roads (e.g., muskegs), a special construction technique will be used which will effectively "float" the road on the less competent underlying material. In this method, a flotation material, typically wood chips or logs, is placed directly on top of the undisturbed surface vegetative mat. A layer of minimally compacted fill material is then laid down followed by a geotechnical fabric which would provide lateral stability, distribute bearing loads over a large area, and allow drainage through the road base. Normal construction methods will then follow until the designed grade was achieved.

Permanent bridges will be of truss and girder construction supported by concrete piers (Fig. 2-11). Construction will be timed to minimize impacts upon spawning salmon or other fish movements and temporary pontoon bridges or stream fords will be used to provide equipment access.

During construction of the facility sites, conveyor and road, both temporary and permanent diversion ditches will be constructed to divert runoff from undisturbed areas either around the construction sites or through culverts installed under the road. These will be maintained until disturbed areas are effectively controlled. Additional drainage and sediment control measures will include surfacing of main roads and facility areas with gravel, and revegetation of road cuts, embankments and other disturbed areas as soon as possible after construction to minimize erosion. In sensitive areas, e.g., adjacent to stream channels, localized sediment control measures will be used, including rock filter dams, gradient terraces with filter ponds, rock drainageways, placement of sediment filter ponds and use of straw or vegetation sediment filters. All disturbed areas will be revegetated and mulched, if necessary, as soon as possible after completion of construction activities.

The access/haul road will be maintained on a regular basis. Maintenance will include grading, bridge, culvert and drainage ditch inspection, repair of any localized erosion on embankments, wetting of the road surface by water trucks to control dust during dry periods, and snow removal by snowblower to prevent buildup of high snow berms which would impede animal movements across the right-of-way.

2.10 OPERATION

2.10.1 Coal Production and Shipping Schedules

Under the optimal four-year full production development schedule, initial production would begin at a low level and build to full production. During the initial year of operation, approximately 1.8 million Mt (2 million short tons) of coal would be produced using two shifts of mine workers per day and truck/shovel operations in the pit. The coal would be transported to the port site on the access/haul road using truck tractors, each hauling two, 45.4 Mt (50 ton) uncovered trailers. The tractors would make approximately 55 round trips per day.

During the second year of operation, production would be increased to about 3.6 million Mt (4 million short tons) per year by adding a second work shift at the mine. The coal would still be hauled by trucks to the port site in approximately 99 round trips per day. Early in the second year, the first dragline would begin working. Later in the second year, the main overland conveyor would commence operation. This would eliminate the need to haul coal by truck to the port site. Production would increase in the third year to approximately 5.4 million Mt (6 million short tons) per year. In the fourth year, full production of 10.9 million Mt (12 million short tons) per year would be reached. In the fifth year, the second dragline would begin operation.

Shipping schedules and frequency would depend upon the size of the ships to be loaded. Table 2-2 shows approximate shipping characteristics for two sizes of ships at full production. At lower production levels not requiring ships, barges would be berthed at the Ladd trestle for up to approximately 200 days per year.

Table 2-2

APPROXIMATE SHIPPING CHARACTERISTICS AT FULL PRODUCTION FOR TWO SIZES OF COAL SHIPS

Characteristics	100,000 dwt	60,000 dwt
Ship arrivals/yr	150	250
Interval between arrivals (days)	2.3	1.4
Berth loading time (hours)	25	15
Approximate berth occupancy	52%	57%

Source: Diamond Alaska Coal Company

2.10.2 Job Skills and Shift Schedules

An estimated total of 848 permanent employees would be employed by the project at full production, with half that total (424) being at the project site at any one time. There would be two 11-hour shifts each day. Thus, half the employees on site (212) would be working and half eating or sleeping at any given time. Employees would work a four-day-on, four-day-off schedule and would be flown back to their homes in Anchorage or on the Kenai Peninsula during their off-work periods. All operations except ship loading would be scheduled for 362 days per year (three-day holiday allowance). Shiploading would be scheduled for 350 days per year to allow 12 days for down time due to weather and ice conditions.

Table 2-3 shows the estimated buildup of new permanent project employees (excluding construction personnel) under the optimal, four-year full production development schedule.

Table 2-3

NEW PERMANENT PROJECT EMPLOYEES (EXCLUDING CONSTRUCTION PERSONNEL) UNDER THE OPTIMAL, FOUR-YEAR FULL PRODUCTION DEVELOPMENT SCHEDULE

	Project Year	New Employees
	1	--
	2	98
Construction	3	276
Mining Begins	4	140
	5	96
	6	86
	7	122
	8	30
Total		848

Source: Diamond Alaska Coal Company

Of these 848 employees, approximately 218 would be heavy equipment operators; 125 operators for trucks, light equipment and other machinery; 289 mechanics, shop hands, electricians, plumbers and other maintenance personnel; 110 miscellaneous personnel including cooks, bakers, house-keepers, dishwashers, and other life support functions; and 106 administrative personnel.

2.10.3 Fuel Handling

Because the project would receive, store, and use sizable quantities of diesel fuel, lubricating oils, and other liquids at various facilities, a Spill Prevention, Control and Countermeasure (SPCC) Plan consistent with federal and state fuel handling standards will be prepared for each facility. Copies of that plan will be kept on file at each facility. Each plan will specify the methods which will be used to prevent and control spills which might occur during transportation, unloading, storage, or use of petroleum products. All personnel at each facility will be trained in spill prevention and appropriate personnel will be trained in the execution of the SPCC plan in case of a spill. Each facility will have adequate equipment available to complete cleanup operations. During construction each contractor will also be instructed in SPCC plan compliance and cleanup methods.

Runoff water from the equipment washdown areas would contain oils, grease, solvents, and other hydrocarbon materials. Traps will be installed to collect these materials before discharge to the pond. In addition, the runoff pond receiving this water will be equipped with a skimming device to separate these materials if the traps fail and route them to storage areas.

Waste oil and other used hydrocarbon materials will be collected, stored, and removed from the project area for recycling or for disposal in approved waste disposal sites. Other hazardous waste materials (e.g., paint, solvents) will be handled and stored separately and shipped from the project area for disposal in approved waste disposal sites.

2.10.4 Air Quality Considerations

Burning of slash material from clearing and grubbing operations will occur only under favorable weather conditions and when permitted by DEC. Otherwise, slash will be buried under an adequate depth of spoil in the mine pit.

At all facilities, operations will be conducted to minimize coal dust, fugitive dust, and other emissions which might affect air quality. At the mine service area and the onshore port site, the coal stockpiles will be oriented to minimize contact with the prevailing north-south winds. Usually, no water will be sprayed onto the stockpiles because of the normal water content of the coal and because the coal will be regularly stacked and recovered and will not remain in the stockpile for long periods. If coal does remain in a stockpile for an extended length of time, periodic applications of water or water with a chemical dust retardant will be used. Tests on the self-heating potential of the coal indicated no susceptibility to fire hazard while exposed to the atmosphere.

The coal stacking and recovery units will use water sprays to control dust during those operations. All conveyor systems will be designed to minimize wind effects. Both the mine conveyors and the main overland conveyor will be partially enclosed. The transfer points, including the second crusher in the mine service area, will use negative pressure systems, water sprays and/or other technology to capture as much coal dust as possible. Coal dust collected from the negative pressure systems will be put back onto the coal conveyors. The first crusher, in the mine area, will not have a negative pressure system since it will be open at the top to permit the trucks to dump coal into it.

Once the coal reaches the shiploader, it will be discharged into the barge or ship holds through a fixed downspout. Coal will not be subjected to wind since the downspout will extend into the ship's hold, keeping most of the dust within the hold.

Fugitive dust will be minimized in several ways. Ground disturbance will be kept to a minimum with disturbed areas being revegetated as soon as possible. Exposed areas which will be continuously used, e.g., roads, pads, laydown areas, would be surfaced with aggregate material. When dry or windy conditions occur, these surfaces will be watered to control dust or truck speeds will be reduced to lower fugitive dust emissions. During the early years of operations when coal is hauled to the port site by trucks, road watering and use of a chemical dust suppressant, if required, will keep fugitive dust emissions to a minimum. Trucks will be properly loaded to prevent spillage when turning or braking. Spillage which does occur will be cleaned up to minimize coal fines on the road surface.

2.10.5 Environmental Training Program

An environmental training program designed to promote environmental awareness and highlight environmental protection and mitigation measures will be developed for contractors and employees. The program will include a description of existing environmental resources, identification of potential environmental impacts related to project operations, and a discussion of environmental protection and mitigation measures with emphasis on employee involvement.

2.10.6 Environmental Coordinator

An environmental coordinator will be located in Anchorage during the construction phase. Through onsite monitoring, the coordinator will assure adherence to project stipulations. During the operational phase, the coordinator will continue to ensure that environmental permit stipulations are met, direct the worker environmental training program, investigate human/wildlife contacts (including road collisions), oversee the various environmental mitigation and monitoring programs, and serve as agency contact for project status reports and site inspections. The environmental coordinator will be represented in the field by a full-time, on-site environmental supervisor with a support team made up of personnel from the revegetation and reclamation staff.

Chapter 3.0

Alternatives

3.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 INTRODUCTION

Three types of alternatives exist for the Diamond Chuitna Coal Project: 1) alternatives that are available to the applicant (action alternatives); 2) alternatives that are available to the agencies which must act upon the applicant's various permit applications (agency alternatives); and 3) the No Action Alternative.

A description of the process of identifying and comparing the action alternatives and selecting the preferred alternatives constitutes the bulk of this chapter. The process is designed to avoid significant adverse project impacts. Identification of agency alternatives, which largely involves minimization of unavoidable adverse impacts is summarized in this chapter; mitigation is detailed in Chapter 6.0. The No Action Alternative is discussed in this chapter.

3.2 ALTERNATIVES AVAILABLE TO THE APPLICANT

Identifying and comparing the alternatives available to the applicant (action alternatives) and selecting the preferred alternative is a process of systematically and rationally reducing a large number of options to a smaller number that ultimately represents the alternative with the fewest adverse impacts. It begins with the EIS scoping process which identified the range of options and then proceeds through screening and analysis stages as described below until the preferred alternative is identified.

3.2.1 Options Initially Considered

The EIS scoping process, described in Chapter 7.0, established important cornerstones for this EIS. First, it identified 10 issues of major concern to be addressed during the EIS process. These issues are described in Section 1.4 and were the bases for ultimately determining the action alternatives. Second, to address the 10 issues, the scoping process identified a full range of options for the project components (Table 3-1). The initial options considered the major technical, environmental, and economic issues associated with the project. These initial options are described below.

Thirty-one options were identified for the 12 project components (Table 3-1). One component, the mine, had only one option since the coal deposit, and therefore the mine location, was fixed. A second component, the mine service

Table 3-1

COMPONENT OPTIONS IDENTIFIED DURING THE SCOPING PROCESS

Component	Option
Mine Location	Fixed
Overburden Stockpile Location	North of mining limit Center Northeast Southeast
Mine Service Area Location	Fixed
Transportation System	
o Corridor/port Location	Northern/Ladd Eastern/Ladd Southeastern/North Foreland Southern/Granite Point
o Mode	Pneumo-train Coarse coal-water slurry Coal-carbon dioxide slurry Road Railroad Conveyor
Loading Facility	
o Type	Filled causeway Elevated trestle
o Length	Short Long
Housing	
o Location	Nikolai Congahbuna Lone Creek Threemile Creek
o Type	Townsite Single status
Airstrip	Existing New
Water Supply	Surface impoundments Wells
Power Supply	Purchase power from Chugach Electric Association

area (Fig. 3-1), was also relatively fixed because of its dependence upon the mine location and because it would be located at the approximate center of the three logical mining units within the lease area, thus allowing its use during future development of other coal resources. For a third component, power supply, the only option considered was purchase of power from the existing Chugach Electric Association power plant at nearby Beluga (Fig. 2-1). Since an existing powerline right-of-way from the Beluga Station would intersect each of the transportation corridor options, this option was clearly more environmentally favorable than any on-site generation option.

3.2.1.1 Overburden Stockpile Location

Four locations for the overburden stockpile were identified: north of the mining limit, in the center of the mining limit, northeast, and southeast (Fig. 3-1).

3.2.1.2 Transportation Corridor/Port Location

Four corridor options were identified (northern, eastern, southeastern, and southern) between the mine site and Cook Inlet (Fig. 3-2).

Northern/Ladd

This corridor would extend approximately 14.5 km (9 mi) east from the mine service area toward the Beluga airstrip, then turn south southeast for approximately 7 km (4.3 mi) to a port site at Ladd just north of the mouth of the Chuitna River, about 5.6 km (3.5 mi) north northeast of Tyonek.

Eastern/Ladd

This corridor would extend approximately 17.6 km (11 mi) east southeast from the mine service area to the same port site at Ladd.

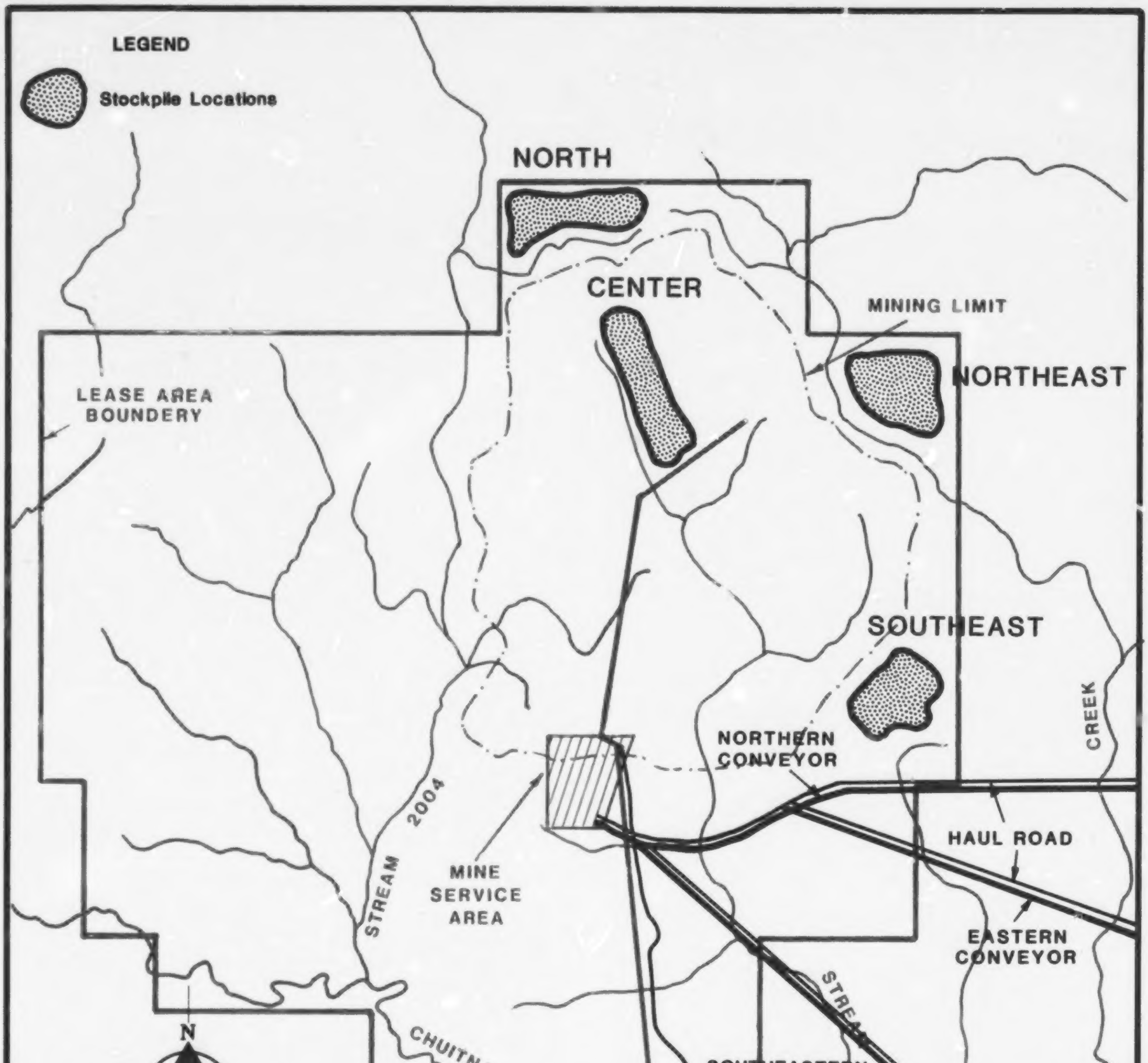
Southeastern/North Foreland

This corridor would extend approximately 18.5 km (11.6 mi) southeast from the mine service area to a port site at the North Foreland, about 2.4 km (1.5 mi) southwest of Tyonek.

Southern/Granite Point

This corridor would extend approximately 17.6 km (11 mi) south from the mine service area to a port site at Granite Point, about 14.4 km (9 mi) southwest of Tyonek.

The existing Ladd Road (Fig. 3-2), primarily used in winter for moving heavy equipment in the region, was not considered since its alignment and condition are such that


LEGEND
Stockpile Locations
NORTH
CENTER
MINING LIMIT
NORTHEAST
LEASE AREA BOUNDERY
SOUTHEAST
NORTHERN CONVEYOR
CREEK
STREAM 2004
MINE SERVICE AREA
HAUL ROAD
EASTERN CONVEYOR
STREAM 2003
CHUITNA RIVER
SOUTHEASTERN CONVEYOR AND HAUL ROAD
LONE
N
SCALE IN MILES
0
1/2
1
2
SOUTHERN CONVEYOR
HAUL ROAD

SOURCE: DIAMOND ALASKA COAL COMPANY

INITIAL MINE AREA OPTIONS LOCATIONS

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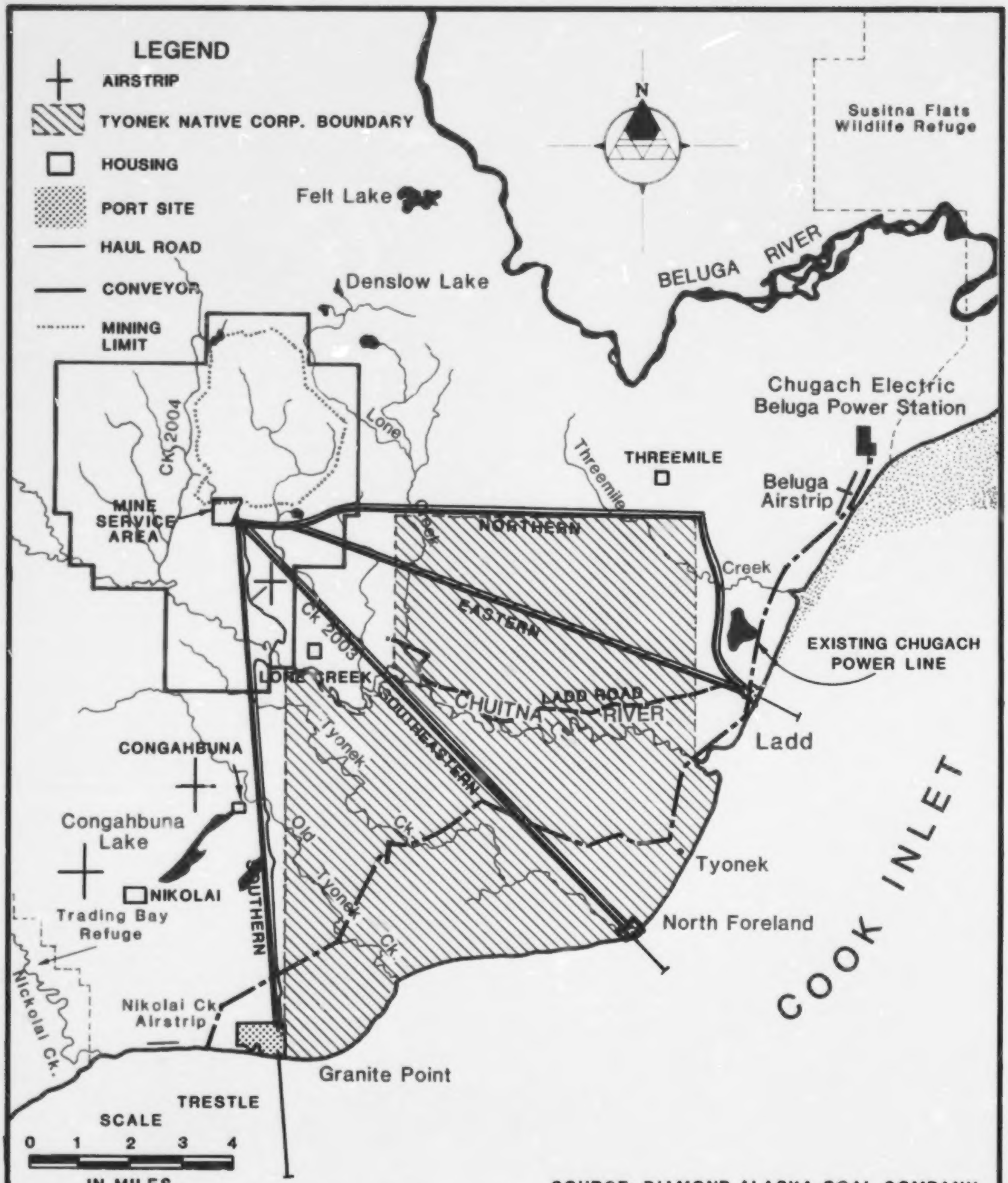
FIGURE 3-1


LEGEND
AIRSTRIP
TYONEK NATIVE CORP. BOUNDARY
HOUSING
PORT SITE
HAUL ROAD
CONVEYOR
MINING LIMIT
N
Susitna Flats Wildlife Refuge
Felt Lake
Denslow Lake
BELUGA RIVER
Ck 2004
Lone
Lone Creek
Threemile
Threemile Creek
THREEMILE
Chugach Electric Beluga Power Station
Beluga Airstrip
MINE SERVICE AREA
NORTHERN
EASTERN
Ck 2003
EXISTING CHUGACH POWER LINE
LONE CREEK
CHUITNA RIVER
LADD ROAD
SOUTHEASTERN
Ladd
CONGAHBUNA
Tyonek Ck
Congahbuna Lake
Old Tyonek Ck.
NIKOLAI
SOUTHERN
Tyonek
North Foreland
COOK INLET
Trading Bay Refuge
Nickolai Ck.
Nikolai Ck Airstrip
Granite Point
TRESTLE
SCALE
0 1 2 3 4
IN MILES

SOURCE: DIAMOND ALASKA COAL COMPANY

INITIAL TRANSPORTATION CORRIDOR, HOUSING AND AIRSTRIP OPTIONS LOCATIONS

Diamond Chuitna Environmental Impact Statement

FIGURE 3-2

it would have to be totally rebuilt with no significant environmental or economic savings.

3.2.1.3 Transportation Mode

Six options were identified for the method of transporting coal from the mine to the port site.

Pneumo-train

In this option, open-top, wheeled capsules would be loaded continuously with crushed coal at the mine and propelled down a buried pipeline by compressed air to the port. There the coal would be dumped and the cars returned to the mine via a second pipeline. The coal would be stored at the port for ship loading.

Coarse Coal-Water Slurry

The coal would be crushed, mixed with water, and pushed through a slurry pipeline to the port. There the coal would be separated from the water, dried, and loaded directly onto ships. The slurry pipeline would operate only when a ship was available for loading, thus eliminating the need for coal storage at the port. Slurry water would be processed and recycled back to the mine in a closed system.

Coal-Carbon Dioxide Slurry

In this option, coal would be washed, crushed to a fine powder, and dried at the mine site. The powdered coal would be mixed with liquid carbon dioxide (CO_2) and transported via pipeline to the port. At the port, the CO_2 would be heated and flashed, thus separating the coal for direct loading onto a waiting ship. No coal would be stockpiled at the port. The CO_2 would be recompressed and returned to the mine.

Road

For this option, the haul road initially built to supply the mine area, which would be used to transport coal to the port for the first years of production, would continue to serve as the transportation mode throughout the life of the project. At full production, approximately twenty-three truck tractors, each hauling two 45.4 Mt (50 ton) uncovered trailers, would make about 311 round trips per day between the mine and the port. Coal would be stockpiled until a ship arrived. This option is not proposed by the applicant.

Railroad

Crushed coal would be loaded at the mine for transport by rail to the port. Approximately 3.3 round trips per day would be made using 100-car trains over 1.6 km (1 mi) in length. Coal would be unloaded from the heavy duty bottom-dump hopper cars and stockpiled until a ship arrived.

Conveyor

For this option, coal would be crushed, placed on a single span, covered, conventional belt conveyor, and carried to the port. Coal would be delivered directly to a ship or taken from the conveyor and stockpiled until a ship arrived.

3.2.1.4 Loading Facility Type

Two options for the coal loading facility were identified.

Filled Causeway

The causeway would be earth-filled and armored with rock. It would support the conveyor and shiploader structures as well as a road for operations and maintenance personnel. The causeway would be used for unloading barges and other fuel and supply ships.

Elevated Trestle

An elevated, pile-supported approach trestle would support the conveyor and shiploader as well as a narrow roadway for operations and maintenance personnel and equipment. While it would not serve supply barges (there would be a separate barge staging area on the beach), it would support a pipeline to move fuel from tankers or barges to storage tanks at the onshore port area.

3.2.1.5 Loading Facility Length

Both short and long loading facilities for full production were considered for each port location. The options represent the facility lengths necessary to reach water depths that would allow use by either smaller (60,000 dwt) or larger (up to 120,000 dwt) vessels. The smaller vessels would require a berthing depth of about 14 m (46 ft) at mean lower low water (MLLW) while the larger vessels would require between 15.2 to 18.3 m (50 to 60 ft) of depth.

3.2.1.6 Housing Location

Four options for the location of worker housing were identified (Fig. 2-1).

Nikolai Site

The Nikolai site is about 9.6 km (6 mi) northwest of Granite Point and 14.4 km (9 mi) south of the mine site. The housing area would be located on the edge of the Nikolai escarpment with a southerly exposure overlooking Trading Bay State Game Refuge.

Congahbuna Site

The Congahbuna site is immediately northeast of Congahbuna Lake, about 8 km (5 mi) north of Granite Point and 9.6 km (6 mi) south of the mine site. This site would be located in the middle of the southern transportation corridor option.

Lone Creek Site

The Lone Creek site is immediately north of the Chuitna River about 12.8 km (8 mi) north of Granite Point. It would be west of Lone Creek and about 4.8 km (3 mi) southeast of the mine site.

Threemile Site

The Threemile site is north of Threemile Creek and south of the Beluga River about 6.4 km (4 mi) west of the Chugach Electric Association Beluga Power Plant. This site is located just north of the northern corridor.

3.2.1.7 Housing Type

Two options for worker housing were identified.

Townsite

The townsite would have a large proportion of individual houses and apartments for workers and their families. Additional community facilities would include schools, hospital, recreation center, religious facilities, town administration offices, police and fire stations, supermarket, and department store. The townsite would function as a largely self-contained entity with workers commuting to work daily from their homes as do most workers in Alaska. No transportation to the townsite from Anchorage would be provided and workers would live and recreate in and around the townsite.

Single Status Housing

Single status housing facilities would provide individual rooms for workers in a camp-type housing complex which would include a dining hall/administration building, recreation center, laundry, medical facilities, and security and fire services. Minimal emphasis would be placed on shopping and commercial facilities since the personal needs of the workers, including routine health care, would be served during their off-work, off-site periods. Workers would be flown to the project area from Anchorage and Kenai for their time on the job and then be returned home for their off-work periods.

3.2.1.8 Airstrip

Two options for location of an airstrip were identified: an existing airstrip in the region or a new one in proximity to the housing area.

3.2.1.9 Water Supply

Two options were considered for supplying both the industrial and domestic water needs of the project: surface impoundments and wells.

3.2.2 Options Screening Process

The options screening process was conducted in two steps. First, all 31 options identified during the scoping process were initially evaluated to eliminate those options which were clearly unreasonable or infeasible for environmental, technical, or other reasons. In the second step, all remaining options not eliminated in step one were evaluated in greater detail.

3.2.2.1 Initial Options Evaluation

Each of the 31 component options identified during the scoping process was individually reviewed from environmental and technical perspectives. If an option were environmentally and technically reasonable and feasible, it was retained for further analysis. If, however, the option was determined to be unreasonable or infeasible, and if other options retained for that component adequately addressed the 10 scoping issues, it was eliminated. Table 3-2 identifies the nine options eliminated during this initial options review, and outlines the major reasons why each was eliminated. Table 3-3 summarizes the results of the initial options evaluation process and shows which options were retained or eliminated.

The elimination of the southeastern/North Foreland transportation corridor/port location option requires some amplification. The North Foreland port site is located on land owned by TNC and was considered as an option because there is an existing port at the site, including a pier, which was used in the 1970s for loading wood chips aboard vessels for transport to market. An analysis of the pier, as well as tidal currents and ice conditions, was conducted by the applicant (Soros Associates 1986) to determine the feasibility of using the North Foreland site. That study,

Table 3-2

MAJOR REASONS FOR ELIMINATION OF INDIVIDUAL OPTIONS DURING INITIAL OPTIONS EVALUATION

Component	Option Eliminated	Major Reasons for Elimination
Overburden Stockpile	Center	o Inside mining limit (stockpiled material would have to be rehandled to mine under stockpile)
	Northeast	o Would require a bridge across Lone Creek o Visual impacts
Transportation Corridor/Port Location	Southeastern/ North Foreland	o Port site tidal currents and ice conditions prevent ship berthing/loading to full project production capacity
Transporation Mode	Pneumo-train	o Demonstration plant technology only
	Coarse coal-water slurry	o Moderate product degradation (10% BTU loss from water) o Unproven Arctic technology o Spill hazard
	Coal-carbon dioxide slurry	o Pilot plant technology only o Spill hazard o Final product not presently marketable
Loading Facility	Filled causeway	o Large quantities of fill and armor rock required o Constant protection from tidal and ice scour required o Interference with anadromous fish movements and local set net fishery
Housing Type	Townsite	o Substantially greater infrastructure required (water, sewer, housing, etc.) o Adverse to local autonomy o Less adaptable to traditional regional lifestyles o Competition with subsistence activities o Greater land area impact o Greater impacts on fish and wildlife (increased hunting & fishing; human/wildlife contacts; etc.)
Water Supply	Surface impoundments	o Block free-flowing streams o Interference with fish movements o High dams to store water in winter

Table 3-3

OPTIONS ELIMINATED OR RETAINED FOR FURTHER ANALYSIS DURING INITIAL OPTIONS EVALUATION

Component	Options Retained	Options Eliminated
Mine Location	Fixed[1]	
Overburden Stockpile Location	North Southeast	Center Northeast
Mine Service Area	Fixed[1]	
Transporation System		
o Corridor/Port Location	Northern/Ladd Eastern/Ladd Southern/Granite Point	Southeastern/North Foreland
o Mode	Road Railroad Conveyor	Pneumo-Train Coarse Coal-Water Slurry Coal-Carbon Dioxide Slurry
Loading Facility		
o Type	Elevated Trestle[1]	Filled Causeway
o Length	Short Long	
Housing		
o Location	Nikolai Congahbuna Lone Creek Threemile Creek	
o Type	Single Status[1]	Townsite
Airstrip	Existing New	
Water Supply	Wells[1]	Surface Impoundments
Power Generation	Purchase[1]	

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[1] Sole option remaining for this component

as reviewed by Dames & Moore, showed low ship berthing availability due to tidal currents and ice for any pier located at that site. While berthing availability would probably be adequate to load coal during the lower coal production levels early in the project, serious difficulties and vessel delay could be expected during full coal production levels of 10.9 million Mt (12 million short tons).

The existing pier was also judged inadequate since water depth is not sufficient to accommodate vessels of 72,576 Mt (60,000 dwt) or larger needed at full production. Further, it is misaligned with respect to dominant ebb and flood current direction, it has an inadequate fender system and sedimentation at the berth, and it is structurally inadequate to support a movable type shiploader needed to load ships at full coal production levels.

As a result of the initial options screening, the number of components with only one option to be considered increased to six. Housing type, water supply, and type of loading facility joined the mine location, mine service area location, and power supply as single option components.

3.2.2.2 Remaining Options Evaluation

Since all options in the applicant's Proposed Projects were environmentally and technically reasonable and feasible, each of those options was retained so that the applicant's Proposed Projects would constitute formal alternatives to be analyzed during the analysis of alternatives process. Then, for each component where at least one option other than the applicant's choice remained, all options were individually evaluated from the perspective of each resource or technical discipline (e.g., water quality, subsistence, technical feasibility, etc.). If it was determined that one of the other options was as good as, or better than, the applicant's option on an overall basis, or if it addressed one or more of the 10 scoping issues in a significantly more favorable manner than did the applicant's proposed option, that option was retained for the analysis of alternatives process.

The following discussions summarize the results of these more detailed analyses and describe why an additional seven options and one component were eliminated from consideration. Generally, only those disciplines which would likely have a reasonable difference in impacts between options are discussed.

Overburden Stockpile

The two remaining stockpile locations, north and southeast (Fig. 3-1), would have similar impacts on water quality and vegetation, but the north site would be closer to fish spawning habitat and would be in the southern portion of a fall moose rutting* area. Also, use of the north site would subject drainage 2004 to project-related disturbance immediately rather than 22 years into the project. The north site would have poorer foundation conditions and would cause greater negative visual impacts than the southeast. On the basis of this analysis, and since it did not address any of the 10 scoping issues more favorably than the southeast site (the applicant's proposed option), the north site was eliminated, leaving the southeast site as the single option for location of the overburden stockpile.

Transportation Corridor/Port Location

Initial analysis of the three options showed that all were environmentally and technically reasonable and feasible. Because of the complicated nature of a discipline-by-discipline comparison among all three options, and since the northern/Ladd option and the eastern/Ladd option shared the same port site, it was logical to do a comparative analysis between these two options to determine if one option could be eliminated.

To compare these options, a specific set of "options screening criteria" was developed to evaluate potential impacts (Table 3-4). Table 3-5 summarizes the comparative resource discipline analyses for the northern/Ladd and the eastern/Ladd transportation corridor/port site options based upon the options screening criteria in Table 3-4. For each of the 10 disciplines, the potential adverse impacts for each option are shown relative to those for the other option. Generally, only those screening criteria having a reasonable difference in adverse impacts between options are discussed.

Analysis of relative potential for adverse impact to water quality showed that since the eastern/Ladd option would be shorter and make fewer stream crossings, it was considered to have a relatively low potential for adverse impact from sediment production during construction, operation, and reclamation. The northern/Ladd option was judged to have a relatively moderate potential for adverse impact.

From a vegetation standpoint, the longer northern/Ladd option would directly affect more vegetation and wetlands. Indirectly, the northern/Ladd option would potentially impact a greater area of vegetation due to traffic-generated dust. Therefore, the northern/Ladd option was judged to have a relatively moderate potential for impact while the eastern/Ladd option was judged to have a relatively low potential.

Table 3-4

TRANSPORTATION CORRIDOR/PORT LOCATION INDIVIDUAL DISCIPLINE OPTIONS SCREENING CRITERIA

Discipline[1]	Options Screening Criteria
Water Quality	Sediment production from road surfaces, cuts, fills, sideslopes and stream crossings Reclamation difficulty Spill Hazard (includes offshore port)
Vegetation	Direct vegetation loss Indirect loss from dust and vehicle or foot traffic Relative value of wetlands lost
Fish	Presence or absence of fish Value in terms of spawning, rearing or migration Number of stream crossings
Wildlife	Direct habitat loss Indirect habitat loss due to noise, other disturbance or human contacts Effects on animal movements
Socioeconomics	Local resident control of, or input to, project through land ownership Proximity of port site to Tyonek Income from corridor and port site leases
Subsistence	Interference with access to traditional use areas Interference with existing harvest activities Changes in resource availability (increased competition, reduced populations, changes in movement patterns)
Recreation	Impacts on existing recreation
Regional Use	Flexibility for other regional uses Size and location of component sites adequate for expansion Preclusion of other users or uses Consolidation with existing facilities
Technical Feasibility	Availability of adequate construction technology Relative complexity of design, construction and operation
Reclamation	Reclamation difficulty

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[1] Includes only disciplines having a reasonable difference in impacts among the options

Table 3-5

COMPARATIVE RESOURCE DISCIPLINE ANALYSIS OF RELATIVE POTENTIAL ADVERSE IMPACTS FOR THE NORTHERN/LADD AND EASTERN/LADD TRANSPORTATION CORRIDOR/PORT SITE LOCATION OPTIONS

	Northern/Ladd			Eastern/Ladd		
Discipline[1]	Low[2]	Moderate	High	Low	Moderate	High
Water Quality		M		L		
Vegetation		M		L		
Fish		M		L		
Wildlife			H		M	
Socioeconomics		M		L		
Subsistence	L			L		
Recreation		M		L		
Regional Use		M			M	
Technical Feasibility	L			L		
Reclamation		M		L		

[1] Includes only disciplines having a reasonable difference in adverse impacts between the options.

[2] "High", "moderate", and "low" are comparative among the three corridor options, not absolute values of potential environmental impacts.

Analysis of the relative potential impact to fish showed that the eastern/Ladd option would involve four stream crossings with two crossings being in areas of high fish value. The northern/Ladd option would involve six stream crossings with at least two crossings being in areas of high fish value. Thus, the overall relative potential for adverse impact for the eastern/Ladd option was judged to be low, while that for the northern/Ladd option was judged to be moderate.

From a wildlife perspective, the northern/Ladd option would directly impact about 14 ha (35 ac) more habitat including wetlands and riparian areas important to waterfowl and bears than the eastern/Ladd option. Indirect habitat loss for swan nesting and rearing would be equally high for both options. The northern/Ladd option would pass within 704 m (770 yd) of an eagle nest. Effects upon animal movements for both options would be similarly moderate, but would be reduced by optimizing the locations of specially constructed wildlife crossings. Therefore, the northern/Ladd option was judged to have a relatively high potential for adverse impacts upon wildlife while the eastern/Ladd option was considered to have a relatively moderate potential.

Analysis of the socioeconomic impacts upon residents of Tyonek showed that the eastern/Ladd option would cross lands owned by TNC, thereby giving Tyonek residents some degree of control over project design and location as well as direct income from a corridor right-of-way lease. The northern/ Ladd option would not cross any TNC lands. Both options would offer the same benefits of proximity to jobs as well as the disadvantages of the port site being relatively close to the village. Thus, the eastern/Ladd option was judged to have a relatively low potential for adverse impact while the northern/Ladd option was judged to have a moderate potential.

From a subsistence perspective, the potential for adverse impact to residents of Tyonek from either the eastern/Ladd option or the northern/Ladd option was considered to be low since Tyonek residents make relatively little use of lands affected by those options. The level of impact to the small number of residents between the Ladd port site and the Beluga power station is unknown, but would likely not differ significantly between the two options.

Analysis of relative potential impact to recreation showed that the northern/Ladd option crossed more streams than did the eastern/Ladd option, including two crossings of Threemile Creek. The northern/Ladd option would also pass close to Viapan and Tukallah Lakes. Thus, the northern/Ladd option was judged to have a relatively moderate potential for adverse impact while the eastern/Ladd option was judged to have a relatively low potential.

From a regional use perspective, there was no significant difference between the options relating to size or ability to expand to accommodate other users, nor was there a difference in consolidation with existing facilities. Both options would cross private land which might restrict other potential uses in the future. The northern/Ladd option would cross the southern extreme of another state coal lease (Fig. 4-1), thus making development more economically feasible by having a road and conveyor right on the lease. This was not judged, however, to be a significant difference considering the relatively small advantage this would provide to the lease holder. Thus, on an overall regional use basis, both options were considered to have moderate potential for adverse impact.

Analysis of technical feasibility showed adequate construction technology exists for both options, with neither having significant complexity of design, construction, or operation. Thus, both options were judged to have a relatively low potential for adverse impacts.

From a reclamation perspective, the northern/Ladd option, with its greater length and acreage of wetlands and higher number of stream crossings, was considered to be more difficult to reclaim. Thus, the eastern/Ladd option was judged to have a relatively low potential for adverse impacts while the northern/Ladd option was judged to have a moderate potential.

Overall analysis of the 10 resource disciplines for the two transportation corridor/port site options showed (Table 3-5) that the eastern/Ladd option clearly had a lower overall potential for adverse impacts than did the northern/Ladd option. The eastern/Ladd option was judged to have a low potential for adverse impacts for eight of the 10 disciplines with none rated as having a high potential, while the northern/Ladd option was judged to have a low potential for impacts for only two disciplines and rated as having a high potential for one.

In final analysis, the eastern/Ladd option was judged preferable to the northern/Ladd option. However, despite its rating, the northern/Ladd option was not eliminated because most potential impacts could be mitigated by proper siting and design of facilities. Therefore, both options were retained and specifically addressed in the comparison of action alternatives process.

Transportation Mode

Table 3-6 summarizes the resource discipline analysis of the three remaining transportation modes for moving coal from the mine to the port: road, railroad, and conveyor (the applicant's proposed option).

Table 3-6

RESOURCE DISCIPLINE ANALYSES OF THE RELATIVE POTENTIAL ADVERSE IMPACTS OF TRANSPORTATION MODE OPTIONS

	Mode								
	Road			Railroad			Conveyor		
Discipline[1]	Low[2]	Moderate	High	Low	Moderate	High	Low	Moderate	High
Water Quality			H	L			L		
Air Quality			H		M		L		
Vegetation	L					H			H
Fish		M		L			L		
Wildlife			H		M		L		
Subsistence		M				H			H
Visual			H		M			M	
Noise			H		M		L		
Recreation			H		M		L		
Economics		M				H	L		
Reclamation	L					H		M	
Regional Use		M		L				M	

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[1] Includes only disciplines having a reasonable difference in adverse impacts among the options.

[2] "High", "moderate", and "low" are comparative among the three corridor options, not absolute values of potential environmental impacts.

For each discipline, the potential adverse impacts for each option are shown relative to the potential impacts for the other two options. For the road option, it is important to keep in mind that a road from the port to the mine would still exist in any event, i.e., the road would be there whether or not another coal transportation mode was constructed. Therefore, cumulative adverse impacts were considered for construction of the other transportation modes. For example, the road would have a lower adverse impact than the railroad or conveyor on vegetation because their construction would destroy additional vegetation, while use of the existing road to haul the coal would cause no additional vegetation destruction (assuming adequate dust control measures). The following discussion addresses only resource discipline analyses which showed a reasonable difference in adverse impacts among the options.

Because of the high level of truck traffic necessary to transport the coal by road at full production (approximately 331 round trips per day), erosion problems, hence potential adverse water quality impacts, would be significantly greater than for either the railroad or conveyor options, both of which were rated as relatively low.

By the same reasoning, the road option rated high for potential adverse air quality impacts. The railroad, which would generate a diesel smoke plume and some dust, was rated as moderate. The conveyor option was rated as low.

From a vegetation perspective, the road option rated relatively low since the road would already exist and only moderate additional vegetation destruction would occur if it continued to be used to haul coal throughout the life of the project. Potential adverse railroad impacts were rated as relatively high due to the necessity to clear and maintain another right-of-way. Although the conveyor itself would sit on elevated supports, it would need an adjacent service road throughout its length which would also require clearing and maintenance of another right-of-way. The conveyor option was also rated as having a relatively high potential for adverse impacts to vegetation.

The greater potential adverse water quality impacts identified for the road option, discussed above, resulted in a relatively moderate rating for potential adverse fish impacts while the railroad and conveyor options were rated as relatively low for this discipline.

From a wildlife perspective, the road option possesses a relatively high level of potential for adverse impacts because of disturbance from noise and vehicle movements associated with the 311 round trips per day (an average of one truck with two trailers passing a given point every 2 minutes, 22 hours per day, 362 days per year). Also, deep snow in winter would cause moose to use the cleared road to move about, resulting in more frequent vehicle/moose collisions. The railroad option would generate substantially less noise and movement on a continuous basis than would the road, but it would have the same problems with moose collisions in winter. It was rated as having a relatively moderate potential for adverse impact. The conveyor would be stationary and would generate significantly less noise. Its main potential adverse impact would be physical blockage of animal movements, a problem not associated with either the road or railroad. Since large animal crossings would be designed into the conveyor option, it was rated as having a relatively low potential for adverse impact.

The road and railroad would potentially have direct adverse impacts upon subsistence resources. The moose population, especially, would be expected to be adversely affected as a result of collisions with vehicles. The railroad and conveyor could also have direct impacts upon subsistence use because they could physically block access across the transportation corridor. With the conveyor generally elevated only 0.6 m (2 ft) above the ground (with no clearance in winter due to snow), traditional winter travel across the corridor could be limited to the road and large animal crossings. The railroad right-of-way could pose a similar though less formidable obstacle, especially to snow machines. Thus, the road was considered to have a relatively moderate potential for adverse impacts on subsistence while the railroad and the conveyor were considered to have relatively high potential for adverse impacts.

Visually, the road, with its frequent truck traffic and associated dust, was judged to have a relatively high level of potential for adverse impact. The railroad, with its 5.5 m (18 ft) high engines and 1.6 km (1 mi) long trains was judged to have a relatively moderate level of potential for adverse impact. The conveyor would be stationary and stand about 2.7 m (9 ft) above the ground and was also judged to have a relatively moderate level of potential for adverse impacts.

The road option was determined to have a relatively high potential for adverse impacts from noise associated with truck traffic. The railroad was judged to have a moderate relative potential impact for noise, while the conveyor was determined to have a relatively low potential impact.

From a recreation perspective, noise and visual considerations (including dust) were the primary factors used to determine effects upon the quality of the recreation experience. On that basis, the road was determined to have a relatively high potential for adverse impact while the railroad was judged to have a relatively moderate potential.

The conveyor, with its stationary nature and lower noise level, was judged to have a relatively low level of potential impact.

On the basis of initial capital as well as operation and maintenance costs, the road option was judged to be of moderate overall economic impact while the railroad was determined as having a relatively high economic impact. The conveyor was judged to have an overall relatively low economic impact.

From a reclamation perspective, the road, which would exist in any event, was considered to have a relatively low potential for adverse impacts. The railroad was judged to have a relatively high potential impact because of the necessity to reclaim the greater cuts and fills necessary to maintain grade and to remove the large bridge across the Chuitna River if the southern corridor option were selected. The conveyor, which would largely be elevated above the ground on pilings, was considered to have a relatively moderate potential for adverse impacts from reclamation.

The railroad seemed to possess some possible advantage over the other two options when considering future regional uses. The road option would exist for other potential users regardless of which other coal transportation mode was built. The conveyor system would be sized for the output of the Diamond Chuitna project only. If another coal development commenced operations during the life of the Diamond Chuitna project or if another large development occurred after the coal mine was terminated, the conveyor system would not have the capacity or geographic flexibility to handle additional coal. The railroad option could provide some advantage for another coal development project favorably located with respect to the right-of-way. However, another project of similar size to the Diamond Chuitna project would probably have to substantially upgrade the size of any existing railroad system to meet its needs. Thus, both the road and the conveyor options were judged to have a relatively high potential for adverse impacts from a regional perspective (i.e., both would have no significant positive effect on promoting a regional coal transportation system), while the railroad was judged to have a relatively moderate level of adverse impacts.

Overall analysis of the three options (Table 3-6) clearly showed that the conveyor option had the lowest levels of relative adverse impacts for the twelve disciplines considered. The conveyor option showed relatively high potential for adverse impacts for only three disciplines: vegetation, subsistence and regional perspective. The relative differences among the three options for potential impacts to vegetation were not judged to be significant. The relatively high adverse impact rating for the regional use discipline was also judged not to be significant because it merely means that the conveyor would not have a positive effect on promoting a regional coal transportation system, but it would not in any way preclude such a system from being developed in the future.

The one major discipline concern for the conveyor was the relatively high potential impact of blocking access to traditional subsistence use areas if the southern corridor/Granite Point option were selected. This concern could be addressed by providing enough crossings to permit subsistence users reasonable access to traditional use areas. It was felt that this potential problem could be adequately handled in the design of that option, and thus the conveyor system (the applicant's proposed option) was judged the best overall transportation mode option for addressing the 10 scoping issues.

Loading Facility Length

Both full production options identified, i.e., a short trestle and a long trestle, were dependent upon vessel draft and water depth. The greatest difference between these options would occur at the Granite Point port site where the shorter trestle would be approximately 2,277 m (7,470 ft) and the longer trestle 3,810 m (12,500 ft). Analysis showed only three areas where a reasonable difference between the options would exist. Visually, the longer facility would have a greater adverse impact. It would also require somewhat greater travel time for a larger boat moving along the coast to pass around it. Smaller boats, which make up the majority of existing use, could sail through the 122 m (400 ft) openings between the trestle supports. From a regional use perspective, however, the longer facility could be considered more favorable because of its increased flexibility for other potential users. None of these three differences was considered significant and neither option addressed any of the 10 scoping issues in a significantly more favorable manner than the other. Thus, it was judged that length of the loading facility was not of significant importance and it was dropped as a component.

Housing Location

Initial analysis of the four housing location options, Nikolai, Congahbuna, Lone Creek (the applicant's proposed option), and Threemile, showed that three of the four sites were corridor specific (Fig. 3-2). Lone Creek was the only option which could be used regardless of which transportation corridor was selected. Both the Nikolai and Congahbuna sites are located well south of the mine area near Granite Point and would be practical only if the southern corridor were selected. The Threemile site is just north of the northern corridor near the Beluga power station and would be practical only if the northern corridor were selected. Since all four sites had already been determined to be environmentally and technically reasonable and feasible, it was decided to retain each corridor-specific option for alternative analysis with its respective corridor. This was predicated on the assumption that the option was the best one for that corridor and that it addressed at least one scoping issue more favorably than did the Lone Creek site. The Lone Creek site would be retained in any event because it is the applicant's proposed option and it is not corridor specific.

Analysis of the Nikolai and Congahbuna options showed that they are within 4.8 km (3 mi) of each other and have many similarities. Because the two sites are so similar, it appeared most logical to compare them to one another to select the more favorable for retention.

Although the Nikolai and Congahbuna sites showed few significant differences among potential adverse resource discipline impacts, the Nikolai site was considered to have more potential for adverse impacts upon both fish and wildlife because it is closer to Nikolai Creek and Trading Bay Refuge. Also, Nikolai would have a greater adverse visual impact because it would be located apart from the conveyor and the haul road whereas Congahbuna would be in the transportation corridor immediately adjacent to the conveyor and haul road. The Nikolai site, being further from the mine site, would also increase the daily cost of transporting the majority of workers to their work stations. From the subsistence perspective, however, there does not appear to be much use of the Nikolai site by local residents while the area in the vicinity of Congahbuna Lake receives some use for hunting, picnicking, and berry picking. Taking all potential impacts into account, the Congahbuna site collectively was judged to be more favorable than the Nikolai site.

A further analysis between the Lone Creek and Congahbuna housing site options showed that the Congahbuna option addressed at least two scoping issues (fish and socioeconomics) in a significantly more favorable manner than did the Lone Creek option. Therefore, the Congahbuna option was retained for alternatives analysis.

Analysis of the Threemile housing site showed this option addressed at least one scoping issue (regional use) in a more favorable manner than did the Lone Creek option. Therefore, the Threemile option was retained for the alternative analysis process.

Airstrip Location

Two options were identified for locating the airstrip to be used to shuttle workers between the project area and their homes in Anchorage and on the Kenai Peninsula: use of a presently existing airstrip in the vicinity of the project area or construction of a new airstrip adjacent to the housing site ultimately selected. The latter is the applicant's preferred option.

Using an existing airstrip would offer the advantages of lower capital costs for construction and less environmental impact at the site of the proposed new airstrip. Disadvantages would include: the possible need to construct additional roads and bridges to access an existing strip; greater operational costs and environmental impacts from transporting workers and equipment significantly greater distances; the necessity to substantially upgrade an existing airstrip; and the possibility of more marginal operating conditions because the existing runway alignment might not be optimum. Other disadvantages related to the operation of an existing airstrip at greater distances from the housing site would include the need to construct larger terminal facilities to shelter workers waiting for planes, the increased risk and liability from unauthorized use of a previously public airstrip by private pilots, hunters or fishermen, and vandalism.

On a more site-specific basis, all currently usable airstrips in the vicinity of the project area which might be upgraded to handle traffic needs for the Diamond Chuitna Project are private. Thus, their availability for use by the project would be uncertain. The major airstrips (Beluga, Tyonek, and Nikolai Creek) would be located approximately 19.2 to 28.8 km (12 to 18 mi) from the mine site. While the Beluga airstrip is presently capable of handling the traffic needs of the project, Tyonek and Nikolai Creek are not. They both would require lengthening and construction of a cross runway. This would probably not be possible at Nikolai Creek because of space limitations and the substantial adverse wetlands impacts which would occur. Whether residents of Tyonek would consent to a major upgrading and operation of a busier airstrip immediately adjacent to the village is doubtful.

Other airstrips in the vicinity are mostly smaller ones built to support short term oil and gas drilling operations. Some are presently useable by small aircraft, but all would require substantial upgrading and construction of a cross runway before being capable of supporting the project's operational needs. From a strictly geographical standpoint, the "Pan Am" airstrip, located only 0.6 km (0.4 mi) east of the Lone Creek housing site, would appear to be the most logical location because it would be close to the mine site. However, its location on the bluff above stream 2003 would prevent it from being upgraded to sufficient size.

On the basis of the advantages and disadvantages discussed above, it was judged that use of an existing airstrip in the vicinity of the project area, as opposed to construction of a new airstrip immediately adjacent to the housing site, would not address any of the 10 issues in a significantly more favorable manner. This option was therefore eliminated.

At the completion of the options screening process, a total of one component and 15 options had been eliminated. The options that were retained and used to form the action alternatives are shown in Table 3-7.

3.2.3 Identification and Description of Action Alternatives

The options screening process left only two components with more than one option remaining: the transportation corridor/port site location and the housing site location. The applicant wishes to retain two transportation corridor/port site options (southern/Granite Point and northern/Ladd). Two alternatives using these options were identified as the applicant's Proposed Project. The applicant's proposal entails development of only one of these transportation corridors and associated port site. A third alternative, using the eastern/Ladd option, is also discussed. Finally, two housing/airstrip options other than the applicant's proposed option at Lone Creek were identified. The following sections describe the action alternatives that have been selected for detailed consideration in this EIS. Table 3-8 presents a matrix showing which components are included in each alternative.

3.2.3.1 Southern/Granite Point Alternative

In addition to the fixed mine and mine service area locations, this alternative would site the overburden stockpile southeast of the mining limit. It includes a conveyor system within the southern transportation corridor to the site at Granite Point (Figs. 2-1 and 3-1). The port coal-loading facility would be an elevated trestle. A single-status housing facility with associated new airstrip would be located at the Lone Creek site. Water would be supplied by wells and power would be purchased from the Chugach Electric Association natural gas power station at Beluga.

3.2.3.2 Northern/Ladd Alternative

This alternative is the same as the southern/Granite Point alternative except the northern transportation corridor to a port site at Ladd would be used (Fig. 2-1).

Table 3-7

OPTIONS USED TO FORM ALTERNATIVES

Component	Option(s)
Mine Location	Fixed
Overburden Stockpile Location	Southeast
Mine Service Area	Fixed
Transportation System	
o Corridor Location	Southern/Granite Point Northern/Ladd Eastern/Ladd
o Mode	Conveyor
Loading Facility	Elevated Trestle
Housing	
o Location	Lone Creek Congahbuna Threemile Creek
o Type	Single Status
Airstrip	New
Water Supply	Wells
Power Generation	Purchase

3.2.3.3 Eastern/Ladd Alternative

This alternative would be the same as the northern/Ladd alternative except that the eastern corridor to a port site at Ladd would be used (Fig. 2-1).

3.2.3.4 Housing/Airstrip Options

Congahbuna Housing/Airstrip Option

This option would be substituted for the Lone Creek housing/airstrip site in the southern/Granite Point alternative with the housing area and the airstrip being located at the Congahbuna site (Fig. 2-1).

Threemile Housing/Airstrip Option

This option would be substituted for the Lone Creek housing/airstrip site in the northern/Ladd alternative with the housing area and the airstrip being located at the Threemile site (Fig. 2-1).

3.2.4 Comparison of Action Alternatives

The three action alternatives were compared to determine the preferred alternative. The Congahbuna and Threemile housing/airstrip options were then compared with the Lone Creek option to determine whether either option provided a significant advantage over the Lone Creek site such that it could substitute for the Lone Creek option in one or more of the alternatives. The analytical basis for the comparisons in this section is provided in the detailed impact discussions in Chapter 5.0. The reader is encouraged to consult Chapter 5.0 for more extensive examination of the major issues.

Evaluation criteria based on the ten issues identified during scoping (Section 1.4) were developed to compare the three action alternatives and the housing options. The criteria are shown in the first column of Table 3-9. For each scenario, the evaluation criteria were applied separately to each alternative to determine the relative values for the total potential impacts for that alternative. It is important to note that the "relative total impact value" assigned to a given alternative for a specific criterion was derived only by evaluation of that alternative relative to the other alternatives for that scenario. The relative values used were low, moderate, and high.

For example, using the third evaluation criterion (Table 3-9), i.e., "Minimize impacts to wildlife and wildlife habitats," each alternative was analyzed from the standpoint of its total potential for impacts to wildlife and wildlife

Table 3-8

DIAMOND CHUITNA PROJECT ACTION ALTERNATIVES

Project Components and Options	Action Alternatives		
	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
Mine Location* - Fixed	X	X	X
Overburden Stockpile Location* - Southeast	X	X	X
Mine Service Area* - South of Mining Limit	X	X	X
Transportation			
a) Corridor/Portsite			
1. Southern/Granite Point	X		
2. Northern/Ladd		X	
3. Eastern/Ladd			X
b) Mode* - Conveyor	X	X	X
Loading Facility* - Trestle	X	X	X
Worker Housing			
a) Location			
1. Lone Creek	X	X	X
2. Congahbuna			
3. Threemile			
b) Type* - Single Status	X	X	X
Airstrip* - New Construction	X	X	X
Water Supply* - Wells	X	X	X
Power Generation* - Purchase Gas	X	X	X

*Components with only one option.

habitat and a relative value (compared to the other two alternatives) was assigned. Only significant differences in potential impacts were considered. Thus the southern/Granite Point alternative had a relatively moderate value for total potential wildlife and wildlife habitat impacts compared to the northern/Ladd and eastern/Ladd alternatives which had relative values of high and low, respectively. Table 3-9 summarizes the relative total impact values for each evaluation criterion. This allows a consistent comparison of alternatives to be made.

It must be emphasized that while a particular alternative might be assigned a high relative total impact value when compared with the other alternatives, it does not necessarily mean that the alternative would have a high absolute impact. In this chapter, therefore, alternatives were assigned a total impact value relative to one another while the actual significance of the alternatives' impacts are described in Chapter 5.0.

Analysis showed that, because of the specific nature of the project and the make-up of the action alternatives, most of the significant potential impacts were associated directly with activities at the mine and that there were relatively few significant differences in potential impacts among the other project components. Since all impacts associated directly with the mine and its attendant operations were common to all alternatives, the comparison of alternatives process addresses only potential impacts associated with the components of the project other than the mine. The locations of the transportation corridor, port site, and the housing and airstrip sites were the only components creating significant differences in potential impacts among alternatives.

Water Quality

Potential water quality impacts were evaluated primarily on the basis of the risk of petroleum product spills and sediment production from road surfaces, pads, cuts, fills, and stream crossings. No significant differences in potential impacts were identified between the southern/ Granite Point and northern/Ladd alternatives. The eastern/ Ladd alternative would have fewer potential impacts since it would be shorter and cross no major streams as would the southern/Granite Point alternative. It would also cross flatter terrain than either of the others. Therefore, the southern/Granite Point and northern/Ladd alternatives were assigned moderate relative total impacts values for water quality while the eastern/Ladd alternative was assigned a low value.

Table 3-9

EVALUATION CRITERIA MATRIX SHOWING RELATIVE' TOTAL IMPACT VALUES ASSIGNED TO THE THREE ACTION ALTERNATIVES

Evaluation Criteria	Southern/ Granite Pt.	Northern/ Ladd	Eastern/ Ladd
1. Minimize risk of water quality degradation and alteration to flows	Moderate	Moderate	Low
2. Minimize impacts to fish and fish habitat	Moderate	Moderate	Low
3. Minimize impacts to wildlife and wildlife habitats	Moderate	High	Low
4. Minimize potential reclamation problems	Low	Low	Low
5. Minimize impacts to set net fishery	Moderate	High	High
6. Minimize impacts to traditional subsistence harvest activities	High	Low	Low
7. Minimize social, cultural, and economic impact upon local residents	Moderate	Moderate	Low
8. Minimize cumulative regional use impacts	Low	Moderate	Moderate
9. Minimize technical complexity	Low	Low	Low
10. Minimize cost	No Data	No Data	No Data

' "High", "moderate", and "low" are comparative among the three corridor options, not absolute values of potential environmental impacts.

Fish

Potential impacts to fish and fish habitat were evaluated primarily on the basis of the presence or absence of fish, the number of stream crossings, and the value of potentially affected streams for fish spawning, rearing or migration.

No significant differences in potential impacts were identified between the southern/Granite Point and northern/Ladd alternatives. The eastern/Ladd alternative would have fewer potential impacts since it would cross fewer streams than the northern/Ladd alternative and would cross no major streams as would the southern/Granite Point alternative. It would also impact fewer lakes than either of the other alternatives. Therefore, the southern/Granite Point and northern/Ladd alternatives were assigned moderate relative total impact values for fish while the eastern/Ladd alternative was assigned a lower value.

Wildlife

Potential impacts upon wildlife were evaluated primarily on the basis of direct and indirect habitat loss since potential impacts arising from interference with movements across the corridors could be largely mitigated by proper design, construction, and operation of animal crossings.

The northern/Ladd alternative was considered to have greater potential impacts than either of the others because it is longer and would cross riparian habitat important to brown bears feeding upon salmon. The southern/Granite Point and northern/Ladd alternatives would have similar impacts to wetlands important to wildlife, but the eastern/Ladd alternative would cross fewer important wetlands than either of them. The eastern/Ladd alternative, unlike the other two alternatives, would also avoid eagle nests. Thus, the eastern/Ladd alternative was assigned a low relative total impact value while the southern/Granite Point and northern/Ladd alternatives were assigned values of moderate and high, respectively.

Reclamation

Essentially all of the major reclamation concerns identified during the scoping process were focused on the mine and its surrounding area. Technology for successful reclamation of the other project components exists and has been demonstrated to be effective for other Alaska projects. Since reclamation procedures that would be used at the mine and its surrounding area would be common to all three alternatives, no significant differences were identified among the three alternatives for this criterion and all were assigned a low relative total impact value.

Set Net Fishery

Potential adverse impacts to the commercial set net fisheries near the port sites were evaluated primarily on the basis of interference with fish movements and existing set net sites caused by the supply barge unloading facility, the approach trestle, and coal vessel traffic.

The Ladd port site and supply barge unloading facility were judged to have a significantly greater potential for impact upon set net sites since they are located in the midst of one of the most productive set netting areas in upper Cook Inlet. The Granite Point site would also impact some set net sites, but to a lesser extent. Both the northern/Ladd and eastern/Ladd alternatives were thus assigned a high relative total impact value while the southern/Granite Point alternative was assigned a moderate value.

Subsistence

Potential subsistence impacts were evaluated primarily on the basis of: 1) effects on access to, and use of, traditional use areas; 2) changes in fish and wildlife abundance; 3) interference with fish and wildlife cycles or movements; 4) increased nonresident harvest of subsistence resources; and 5) the possibility of increasingly restrictive harvest regulations.

The southern/Granite Point alternative was judged to have a significantly greater potential for impacts to subsistence since the lower corridor and port site would be in areas traditionally used for subsistence by residents of Tyonek while the other two alternatives are located in areas with no significant subsistence use. Also, the southern/ Granite Point alternative would open access to the Chuitna River to impacts on subsistence fish species. Therefore, the southern/Granite Point alternative was judged to have a high relative total impact while the northern/Ladd and eastern/Ladd alternatives were judged to have low values.

Socioeconomics

No significant differences in socioeconomic impacts to Anchorage or the Kenai Peninsula were identified among the three alternatives. Potential socioeconomic impacts to Tyonek were evaluated primarily on the basis of effects upon: 1) local employment, 2) community population and infrastructure, and 3) social and cultural values.

No significant differences were identified among the three alternatives for local employment since Tyonek is connected to the southern/Granite Point alternative by the existing road system and a small vehicle bridge would be built across the lower Chuitna River to provide access to either of the two other alternatives. The social and cultural impacts to residents of Tyonek would be similar for any of the three alternatives. If the eastern/Ladd alternative were selected, however, it could give Tyonek a significantly greater degree of control over the project and would increase the applicant's accountability to the community. Tyonek would also receive revenue from the transportation corridor right-of-way lease. Therefore, the eastern/Ladd alternative was assigned a low relative total impact value while the southern/Granite Point and northern/ Ladd alternatives were assigned moderate values.

Regional Use

Potential impacts to regional use were evaluated primarily on the basis of consolidation with existing facilities, potential for other regional uses, and component size, location, and adequacy for expansion.

The southern/Granite Point alternative would be closer than the other two alternatives to areas most likely to be developed in the future (e.g., the Placer U.S. Center Ridge coal deposit west of the Diamond Chuitna project area). This could have a positive effect upon the feasibility of some potential developments since a crossing of the Chuitna River would not be required to reach the port site as would be necessary with either the northern/Ladd or eastern/Ladd alternative.

The southern/Granite Point alternative would also consolidate with the existing road system and facilities in the Granite Point area while the other alternatives would not consolidate with existing facilities to the same extent. This, however, was not judged to be significant.

The southern/Granite Point alternative would be constructed entirely on public land and the port site would have ample room for expansion, thus likely making the corridor and port site available to other potential users. The northern and eastern corridors, however, would cross some private lands which may not be available to future users. Also, while the port site at Ladd is public land, the amount of public land is not as large as at Granite Point, possibly precluding expansion to accommodate other users and requiring development of another port.

In the final analysis, the southern/Granite Point alternative was judged to have a low relative total impact value while the northern/Ladd and eastern/Ladd alternatives were judged to have moderate values.

Technical Complexity

Potential technical complexity impacts were evaluated primarily on the basis of the availability of adequate technology and the relative complexity of design, construction, and operation. Adequate technology presently exists to design, construct, and operate all three alternatives. Both port sites have shoals offshore which would need to be considered in navigating ships during operations. This was not considered a significant cause for concern in either situation. Therefore, all three alternatives were assigned a low relative total impact value.

Cost

No comparative cost data for any of the three alternatives were made available by the applicant. Therefore, no relative total impact values have been assigned for this criterion.

3.2.5 Identification of Preferred Alternative

The comparison of alternatives process described above assigned relative total impact values to the three action alternatives for each of the ten evaluation criteria (Table 3-9). It should be remembered that when using relative total impact values, the lower the value the better, i.e., a lower value equates with a lower potential for adverse impact. Inspection of Table 3-9 shows that for the nine evaluation criteria for which data were available, seven showed significant differences among the three alternatives: water quality, fish, wildlife, set net fishery, subsistence, socioeconomics, and regional use.

The eastern/Ladd alternative clearly had the lowest overall relative total impact value. For five of the seven criteria showing a significant difference among the alternatives, it received a low rating. Only for the set net fishery criterion did it receive a high rating.

While impacts to set netters from a port site at Ladd could be significant, proper scheduling and operational management at the port site would likely substantially reduce or eliminate significant impacts to the fishery. Such impacts probably would not occur from coal loading operations at full production which would take place at the end of the trestle over 3 km (1.8 mi) from shore, but rather from the supply barge staging area on the beach adjacent to the trestle. Since the set net sites are used only during the fishing season, and then only on certain days of the week, proper scheduling of incoming supply barges to avoid fishing openings and to accommodate local fishermen's traditional uses could likely avoid serious impacts.

On the basis of its having the least overall relative total impact value and the capability of substantially reducing or eliminating significant impacts to the lone criterion (set net fishery) for which it received a high rating, the eastern/Ladd alternative was identified as the preferred alternative.

Whether the applicant could develop an eastern corridor, however, is not certain. The corridor would cross private land owned by TNC and to date, the applicant and TNC have been unable to negotiate a right-of-way agreement.

The southern/Granite Point and northern/Ladd alternatives showed significant differences in potential impacts for four criteria: wildlife, set net fishery, subsistence, and regional use (Table 3-9). The potential exists for significantly greater impacts to the set net fishery for the northern/Ladd alternative and the eastern/Ladd alternative. Proper scheduling and operational management, however, would substantially reduce or eliminate such impacts.

The differences for the wildlife criterion were considered significant. The northern/Ladd alternative would have greater adverse quantitative and qualitative habitat impacts for brown bear that could not be mitigated to eliminate those differences.

For the subsistence criterion, the southern/Granite Point alternative would have significantly greater adverse impacts that could not be mitigated to eliminate the differences. The northern/Ladd alternative would have very limited impact on subsistence values while the southern/ Granite Point alternative would be built through a significant traditional use area.

From the regional use perspective, the low potential for adverse impacts for the southern/Granite Point alternative was considered a significant benefit. The size of the area available for the port site at Granite Point as well as its geographic location with respect to likely future developments and the southern corridor's location entirely on public land were considered to be significantly better than for the northern/Ladd alternative.

Thus the lower potential for adverse impacts from the southern/Granite Point alternative for the set net fishery, wildlife and regional use criteria were countered by the higher potential for impacts for the subsistence criterion. Therefore, on an overall basis the southern/Granite Point alternative was judged to have a lower potential for adverse impacts than did the northern/Ladd alternative. Although the preponderance of higher potential for adverse impacts to the evaluation criteria from this comparison were attributed to the northern/Ladd alternative, the potential effects upon local residents from the higher impacts to subsistence from the southern/Granite Point alternative were not lightly dismissed. Thus, while the overall potential for adverse impacts was judged higher for the northern/Ladd alternative, it was not a clear cut difference.

3.2.6 Comparison of Housing/Airstrip Options

The three alternatives compared above all used the Lone Creek site as the option for the housing and airstrip components. Two other options were identified for those components and are compared below to the Lone Creek site. These are the Congahbuna and Threemile sites. The purpose of this comparison was to determine whether either site provided a significant advantage over the Lone Creek site such that it could be substituted for the Lone Creek option in one or more of the alternatives.

The differences in impacts to the evaluation criteria among all three housing/airstrip sites are described below. For each criterion, the basis for the evaluations were the same as those used above in comparing the three alternatives (e.g., spill risk and sediment production for water quality, direct and indirect habitat loss for wildlife, etc.). The relative total impact values assigned to a criterion for each housing/airstrip option are shown in Table 3-10.

Water Quality

No significant differences in potential water quality impacts were identified for any of the three options. Therefore, each was assigned a low relative total impact value.

Fish

The Congahbuna site would have a lower impact than Lone Creek since it is located at least 3.2 km (2 mi) from the Chuitna River, thus making it more difficult for workers to fish. The Threemile site would have a greater impact than Lone Creek as its location would permit access to several lakes or streams with fish. Thus, the Congahbuna site was judged to have a low relative total impact value while the Lone Creek and Threemile sites were judged to have values of moderate and high, respectively.

Table 3-10

EVALUATION CRITERIA MATRIX SHOWING RELATIVE TOTAL IMPACT VALUES ASSIGNED TO THE THREE HOUSING OPTIONS

Evaluation Criteria	Lone Creek	Congahbuna	Threemile
1. H_2O Quality	Low	Low	Low
2. Fish	Moderate	Low	High
3. Wildlife	Low	Moderate	Moderate
4. Reclamation	Low	Low	Low
5. Set Net	Low	Low	Low
6. Subsistence	Moderate	High	Low
7. Socioeconomic	Low	Low	Low
8. Regional Use	Low	Low	Low
9. Technical Complexity	Low	Low	Low
10. Cost	No Data	No Data	No Data

Wildlife

Both the Congahbuna and Threemile sites would have a greater impact upon waterfowl and swans than would the Lone Creek site as they would be located close to areas used by waterfowl and swans for breeding, resting, and some migration. Therefore, the Lone Creek site was assigned a low relative total impact value while the Congahbuna and Threemile sites were assigned moderate values.

Reclamation

Technology for successful reclamation of the housing and airstrip facilities at any of the three sites exists and has been demonstrated to be effective for other Alaska projects. Therefore, each of the sites was assigned a low relative total impact value.

Set Net Fishery

No significant differences in potential impacts to the set net fishery were identified for any of the sites. Therefore, each of the sites was assigned a low relative total impact value.

Subsistence

The Congahbuna site would have potential for significantly greater impacts to subsistence than the Lone Creek site as it would be located in an area of traditional subsistence use. The Threemile site would have somewhat lower potential for impact than the Lone Creek site since it would be well removed from areas of traditional subsistence use. Thus, the Congahbuna option was assigned a high relative total impact value while the Lone Creek and Threemile options were assigned moderate and low values, respectively.

Socioeconomics

Both the Congahbuna and Threemile options would have somewhat less potential impact than the Lone Creek option since there would be less fishing in the Chuitna River by workers and the local fishing guides would not have as much competition for fish. This, however, was not considered to be a significant difference. Therefore, all three options were assigned low relative total impact values.

Regional Use

Future developments (e.g., coal) would be most likely to take place to the northwest of the Diamond Chuitna project area. The Congahbuna housing and airstrip site would be closer to these potential development sites than would be either Lone Creek or Threemile. Closer inspection, however, shows that its distance from potential developments is great enough that the site would not likely be used by other developments in the region and thus any advantage over the Lone Creek site probably would be negligible. Thus, all three sites were judged to have a low relative total impact value.

Technical Complexity

Adequate technology presently exists to design, construct, and operate all three options. Therefore, all three options were assigned a low relative total impact value.

Cost

No comparative cost data for any of the three options were made available by the applicant. Therefore, no relative total impact values have been assigned for this criterion.

Identification of Preferred Housing/Airstrip Option

The results of the comparison of housing/airstrip options described above are shown in Table 3-10. There were few significant differences among the three options. For six of the nine criteria for which data were available, all three options showed uniformly low relative total impact values. For the three criteria for which significant differences existed (fish, wildlife, and subsistence), both the Congahbuna and Threemile options received alternately higher and lower values than the Lone Creek option such that neither emerged as having an overall significantly lower potential for adverse impacts than the Lone Creek option. For example, the Congahbuna option was judged to have values of low and high, respectively, for the fish and subsistence criteria while the Threemile option received values of high and low, respectively, for the same criteria. The Lone Creek option received moderate values for both criteria.

In final analysis, therefore, there was no basis for substituting either the Congahbuna or Threemile housing/airstrip options for the applicant's preferred option at Lone Creek in any of the three alternatives.

3.3 ALTERNATIVES AVAILABLE TO THE AGENCIES

There are three alternatives available to EPA, the Corps, DNR, and other state and local agencies through each agency's permitting responsibilities. They can: 1) issue permits as proposed with standard stipulations, 2) deny the permits, or 3) issue the permits with stipulations tailored to this project which address specific impacts. Generally, the third alternative is preferable because it allows the project to proceed while minimizing the unavoidable adverse impacts.

Although it is not the purpose of this EIS to decide what stipulations the agencies should impose, it is appropriate to review the relative advantages and effectiveness of the various mitigation options which agencies may require as permit stipulations. The major mitigation options available to the agencies are discussed in Chapter 6.0.

3.4 NO ACTION ALTERNATIVE

The No Action Alternative means that development of the Diamond Chuitna project would not occur. This alternative may be used as a baseline to which the action alternatives can be compared.

The No Action Alternative would result from denial of one or more federal or state permits necessary for project development or a decision by the applicant not to undertake the project.

Chapter 4.0

Affected Environment

4.0 AFFECTED ENVIRONMENT

4.1 INTRODUCTION

This chapter describes the environment as it currently exists without the proposed project, emphasizing those environmental aspects of the Diamond Chuitna project area that could be affected by the construction, operation, and reclamation of the proposed mining and support facilities. As required by federal (NEPA) regulations, these descriptions stress the elements of the natural and human environments that are most likely to be impacted or which have been identified as likely areas of concern through the scoping process.

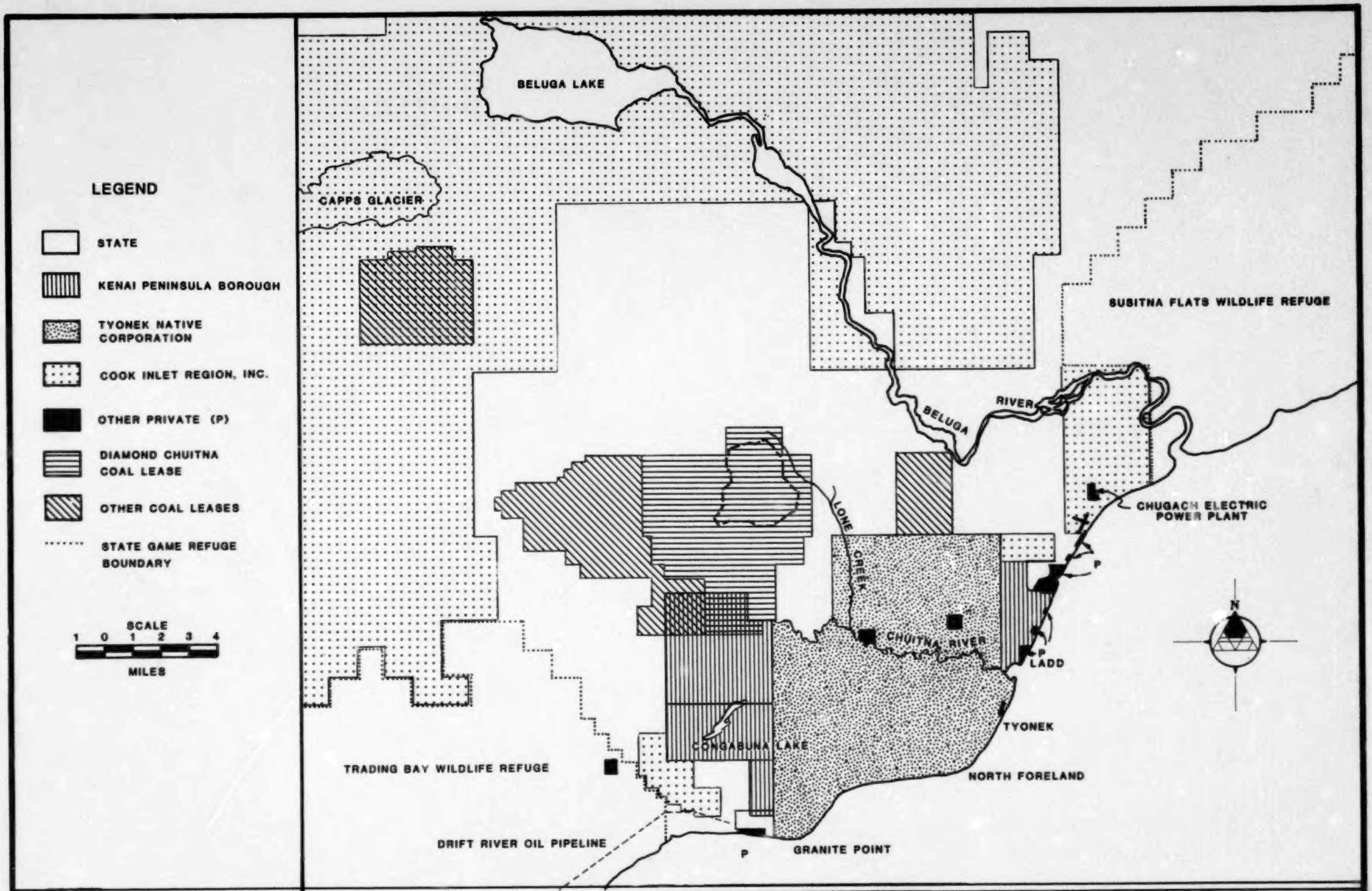
Much of the following information is derived from baseline environmental investigations that were initiated in 1982 and largely completed in 1984. Some additional work was done in 1986. The baseline study reports provide an important source of detailed information and are on file at the sites identified on page ii and in Section 7.7. The following reports are incorporated by reference into this EIS: ERT 1983, 1984a, 1984b, 1984c, 1984d, 1984e, 1984f, 1984g, 1985d, 1986, 1987; Gerlach and Lobdell 1984, 1986; Science Applications, Inc. 1984; and Riverside Technology, Inc. 1986.

4.2 REGIONAL HISTORY AND LAND STATUS

The Beluga region was first settled by Tanaina Indians who lived along the coast in the general vicinity of the present Native village of Tyonek. In 1915, the Moquawkie Indian Reservation was established for the benefit of the Natives living in the Tyonek area. In the early 1970s, reservation status ended and the Natives chose to participate as a village corporation under the Alaska Native Claims Settlement Act (ANCSA).

Exploration and development of natural resources have produced the primary impacts on the region. Major oil and gas exploration began in the early 1960s and included lands within the Moquawkie Indian Reservation. The first major permanent development in the region was the construction of Chugach Electric Association's natural gas power plant at Beluga which began operations in 1968 (Fig. 4-1).

The presence of coal outcrops in the region has been known since the early 1900s. Shortly after statehood, a major portion of the Beluga coal fields was selected by the State of Alaska under the federal government's mental health land grant entitlement. Coal exploration began in the 1960s


LEGEND
STATE
KENAI PENINSULA BOROUGH
TYONEK NATIVE CORPORATION
COOK INLET REGION, INC.
OTHER PRIVATE (P)
DIAMOND CHUITNA COAL LEASE
OTHER COAL LEASES
STATE GAME REFUGE BOUNDARY
SCALE
1 0 1 2 3 4
MILES
BELUGA LAKE
CAPPS GLACIER
SUSITNA FLATS WILDLIFE REFUGE
BELUGA
RIVER
LONE CREEK
CHUITNA RIVER
CHUGACH ELECTRIC POWER PLANT
P
LADD
TYONEK
NORTH FORELAND
CONGABUNA LAKE
TRADING BAY WILDLIFE REFUGE
DRIFT RIVER OIL PIPELINE
GRANITE POINT
N

BELUGA REGION LAND (SURFACE) OWNERSHIP STATUS

Diamond Chuitna Environmental Impact Statement

FIGURE 4-1

with the first leases issued in the late 1960s. A number of coal leases exist in the region today (Fig. 4-1).

In the mid-1970s, the State sold the salvage rights to a large amount of beetle-killed spruce timber west of the Tyonek Native Corporation lands. The ensuing logging operation established a road network in the area that ultimately stretched west through the Trading Bay Wildlife Refuge and across the Chakachatna River. The logs were trucked to a new facility constructed on Tyonek Native Corporation land at North Foreland where they were processed into wood chips and loaded onto ships from an elevated trestle.

There are four major landowners in the region today (Fig. 4-1). Most of the project area, including all the Diamond Chuitna lease area, the Granite Point port site, and about one-third of the southern transportation corridor, is state land as is the Trading Bay State Game Refuge to the south. In April 1985, a land use plan was adopted by DNR which designated development of coal resources as the primary management objective for their lands in the Beluga area. Most of the land east of the project area is owned or selected by the Tyonek Native Corporation, while Cook Inlet Region, Inc. (CIRI) owns the majority of the remainder of the land on the northeast, north, and west. The Kenai Peninsula Borough has either selected or received selection approval to approximately 6,249 ha (15,440 ac) around the southern portion of the southern transportation corridor just north of the Granite Point port site. In addition, the Borough owns approximately 1,416 ha (3,500 ac) along the coast between the Beluga airstrip and the Chuitna River including the Ladd port site. Title to the subsurface estate under all state and most borough lands lies with the State, while CIRI holds title to all subsurface estate under its lands, those of the Tyonek Native Corporation, and some borough lands. There are relatively few parcels of privately owned land in the region.

4.3 TERRESTRIAL ENVIRONMENT

4.3.1 Physiography, Geology, and Soils

4.3.1.1 Physiography

The Beluga region lies between the Beluga River and the Middle River and consists mainly of the broad Beluga Plateau which is of generally low to moderate relief (Schmoll et al. 1984). Streams have dissected the overburden and underlying sedimentary rock creating valleys ranging from a few tens of feet to several hundred feet in depth. Elevations range from about 49 m (160 ft) near the coast to about 427 m (1,400 ft) near the northwestern edge of the lease area. The study area has typical morainal* topography characterized by irregular ridges and depressions (ERT 1985d).

The project area is flanked on the northwest by higher portions of the plateau and adjoining foothills which rise westward toward the Alaska Range and, to the southwest, by estuarine* and alluvial* lowlands of the Chakachatna-McArthur embayment. South of the proposed mining area are lowlands covered by extensive bogs and marshes with numerous ponds and lakes. Areas near the larger streams are generally well-drained. The Beluga region is drained primarily by the Beluga and Chakachatna rivers, which are glacier-fed, and the Chuitna River which heads on the Beluga Plateau. In addition, several other streams, such as Tyonek Creek, Old Tyonek Creek, and Nikolai Creek, drain directly into Cook Inlet (ERT 1985d).

4.3.1.2 Geology

The primary regional geologic features in the area are plutonic* and volcanic* rocks and ash deposits, sedimentary rocks, and glacial deposits. Mount Spurr, an active volcano of the Alaska-Aleutian batholith*, lies about 48 km (30 mi) west of the site and has been active since at least Tertiary times. Extensive ash deposition occurred from about 3,000 to 6,000 years ago. South and west of the site, extrusive* and intrusive* igneous* rocks consisting primarily of andesites*, granodiorites*, and volcanic breccias* of Jurassic and Tertiary ages, and pyroclastics*, are exposed over extensive areas (ERT 1985d).

The central portion of the Beluga Plateau, including the project area, is characterized by a sedimentary plateau mantled by Quaternary glacial deposits. The sedimentary rocks consist of the Tertiary West Foreland Formation (noncoal-bearing) and the overlying Kenai Group. The Kenai Group consists of interbedded claystone, siltstone, sandstone, and conglomerate with numerous coal beds. Coal is also known to occur in the overlying Beluga Formation (ERT 1985d).

The coal-bearing sedimentary rocks in the lease area are part of the Tertiary Tyonek Formation of the Kenai Group. The Tyonek Formation is a sequence of fluvial* and deltaic* clays, silts, and sands with occasional gravel beds and coal seams. It is characterized by its extreme variability both laterally and vertically, with facies* and thickness changes over very short distances. Although at least 18 coal seams (including stringers*) are known to occur within the lease area, only four are thought to be of adequate areal extent and thickness to be significant for mining. The coals are of sub-bituminous* C rank, and are very low in sulfur content, ranging from 0.05 to 0.45 percent sulfur (ERT 1985d).

Five major Pleistocene glacial advances have been recognized in the Cook Inlet region; three of these have contributed to surface deposits within the Beluga region. All of the advances were characterized by dominant advances from the base of the Alaska Range at the northwest, toward lesser advances from the Kenai Peninsula on the southeast (ERT 1985d).

Thicker Quaternary deposits in the region include the embayment deposits* in the Chakachatna-McArthur River area and the Bootlegger Cove clay (ERT 1985d).

Composition of overburden, interburden, and coal seams have been extensively analyzed for plant growth suitability and water quality projections. Table 4-1 illustrates the average physicochemical characteristics of overburden and interburden material that would be encountered during mining. Sufficient quantities of selected parameters are present which accounts for the existing slightly elevated water quality concentrations discussed in the water quality section.

4.3.1.3 Seismology

Two major faults trend northeastward across the region: the Lake Clark fault to the north and the Bruin Bay fault to the south. They are believed to converge within 16 km (10 mi) northeast of the proposed mining site. There is a potential for seismic events ranging from the severe 8.5 Richter magnitude* earthquake of 1964 to short-duration, low-magnitude tremors that occur commonly throughout the Cook Inlet region (ERT 1985c).

During the 1964 earthquake, the Cook Inlet region experienced a variety of ground failures including slumping of surficial deposits toward steep unconfined slope faces, ground-water extrusion of sand and gravel, and landslides on gentle to moderate slopes resulting in tensional cracking and pressure ridges. These effects occurred near the Diamond Chuitna project area which was near the line of zero land level change (ERT 1986). According to the U.S. Army Corps of Engineers, the project area is located within Seismic Risk Zone* 4. This designation applies to areas that could be affected by earthquakes having a magnitude of 7 producing a peak acceleration of 0.4 gravity.

4.3.1.4 Soils

Surficial materials in the project area generally consist of alluvium, peat, and glacial deposits (non-homogeneous mixtures of clay, silt, sand, gravel, cobbles, and boulders) and minor amounts of loess* and volcanic ash. Alluvium is primarily found along stream drainages and consists of poorly-sorted cobbly sand to well-sorted sand and silt. Alluvial deposits are generally

TABLE 4-1

STATISTICAL ANALYSIS OF PHYSICOCHEMICAL CHARACTERISTICS ACROSS NINETEEN DRILL HOLES IN THE DIAMOND CHUITNA MINE AREA

Statistic	pH	EC mmhos/ cm	SAR	ESP	H2O Soluble Na	H2O Soluble Ca	H2O Soluble Mg	NH_4-OA_c Ext. Na	CEC	As	Mo	B	Al	Neutralization Potential	Acid Base Account	Sulfur SO4	Sulfur Pyrite	Sulfur Residual
					meq/L	meq/L	meq/L	meq/100g	meq/100g	ppm	ppm	ppm	ppm	T $CaCO_3$/ 1000 T Soil	T $CaCO_3$/ 1000 T Soil			
Mean	6.3	1.1	5.0	1.8	5.99	3.85	2.25	0.31	19.5	0.12	0.35	0.18	1.02	13.6	12.5	0.01	0.01	0.03
Minimum	4.1	0.1	0.3	0.5	0.18	0.05	0.02	0.18	0.9	0.005	0.01	0.01	0.02	2.0	1.0	0.005	0.005	0.005
Maximum	8.1	3.8	48.6	7.0	33.80	30.70	24.40	1.10	69.0	2.78	1.92	2.50	293.00	38.0	35.0	0.08	0.05	0.19
Observations	335	335	125	64	365	365	365	64	199	270	336	334	365	86	86	86	86	86

	Coarse Fragments	Particle Size Total	Particle Size Sand Coarse	Particle Size Sand Fine	Particle Size Silt	Particle Size Clay	% Saturation	% Organic Matter	K Factor	K	Cl	CO_3	HCO_3	SO_4	Ca	Mg	K
		%	%	%	%	%				meq/L	meq/L	meq/L	meq/L	meq/L	meq/100g	meq/100g	meq/100g
Mean	13.2	51.3	44.4	11.0	33.9	15.0	37.3	2.3	0.40	0.36	0.41	0.18	3.80	2.74	10.02	2.79	2.30
Minimum	0.0	0.0	0.0	0.6	1.6	0.0	5.6	0.05	0.09	0.03	0.005	0.005	0.005	0.005	1.21	0.17	0.08
Maximum	64.3	98.2	89.0	51.6	84.9	54.4	89.1	14.3	0.70	5.92	2.50	2.93	23.4	15.80	25.00	12.40	11.80
Observations	219	347	135	134	352	352	333	144	137	229	199	199	199	191	64	64	64

	Se	Hg	Zn	Fe	Mn	Cu	Cd	Pb	Ni	Cr	Be	P	NH4 + NO_3	Total N
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
Mean	0.01	0.10	10.76	119.03	20.28	6.50	0.25	3.16	5.09	0.23	0.01	2.10	14.73	0.15
Minimum	0.01	0.01	0.07	0.10	0.84	0.22	0.22	0.05	0.12	0.05	0.00	0.30	4.30	0.01
Maximum	0.01	0.67	312.00	1760.00	101.00	21.50	2.47	10.70	83.00	1.50	0.03	12.50	60.30	0.91
Observations	196	197	229	229	229	229	229	229	229	229	229	191	63	62

shallow, ranging from 3 to 9 m (10 to 30 ft). Peat deposits are found in depressions in the glacial deposits. They are characterized by accumulations of organic matter in various stages of decomposition, frequently interbedded with compacted sandy materials. Upland mineral soils are generally organic-rich and are typically underlain by glacially-derived soils at depths of 76 to 114 cm (30 to 45 in) (ERT 1985d).

From the agronomic point of view, the soils of the project area are composed of numerous series* that represent both organic and mineral profiles (Soil Conservation Service 1980). The relationship between soils and vegetation for the project area is shown on Table 4-2. General profile characteristics of soil units are listed in Table 4-3.

Upland soils include the Talkeetna series which consists of several sandy loam variants. The soils are loessal and volcanic in origin and overlie glacial till. Other mineral soils are associated with alluvium along streams and primarily include the Killey-Moose River complex, although Cryaquents and Histosols were also mapped on alluvial floodplains and sandbars (Table 4-2) (ERT 1984d).

Poorly drained organic soils dominate much of the project area. Starichkof taxadjunct and Chichantna soils are associated with decomposed peat and muskeg (Table 4-3). Starichkof peats are similar to the Starichkof-Chichantna soils, comprised of peat with thin layers of volcanic ash, but occur primarily near the coast. Jacobsen mucky fine sand occurs on muskeg perimeters and poorly drained swales. Thus, this series is closely associated with the Starichkof organic soils prominent in bogs and the wetter areas of muskeg.

4.3.2 Vegetation

4.3.2.1 Plant Communities

The vegetation of the project area is broadly characterized as closed spruce-hardwood forest (Viereck and Little 1972) and as bottomland spruce-poplar forest, high brush, and wet tundra (Joint Federal State Land Use Planning Commission for Alaska 1973). A complex of forest, woodland, and shrub communities has been identified within these broader life-form types by an interagency vegetation inventory (U.S. Forest Service - U.S. Soil Conservation Service 1982) and by a baseline investigation specific to the proposed Diamond Chuitna mine lease and transportation corridor (ERT 1984g).

Table 4-2 lists the major vegetation units for the project area. Forests are formed by both open (25 to 75 percent tree cover) and closed (more than 75 percent tree

Table 4-2

MAJOR VEGETATION UNITS AND COMMUNITY TYPES AND ASSOCIATED SOIL SERIES OF THE DIAMOND-CHUITNA PROJECT AREA

Major Vegetation Units[1]	Characteristic Community Type	Associated Soil Series
Forest		
Closed Paper Birch Broadleaf Forest	*Betula papyrifera*/*Oplopanax horridus*/*Cystopteris* spp. Paper birch/devil's club/bladder-fern	Mutnala (Typic Cryorthods)[2]
Open Balsam Poplar Broadleaf Forest	*Populus balsamifera*/*Alnus tenuifolia*-*Viburnum edule*/*Calamagrostis canadensis*-*Polypodium* sp. Balsam poplar/thinleaf alder-highbush cranberry/bluejoint reedgrass-polypody fern	Killey (Typic Cryaquents)
Open Mixed Birch-Spruce Forest	*Betula papyrifera*-*Picea glauca*/*Menziesia ferruginea*/*Polypodium* sp. Paper birch-white spruce/rusty menziesia/polypody fern	Mutnala (Typic Cryorthods)[2] Spenard (Sideric Cryaquads)[2] Jacobsen (Histic Cryaquepts)
Woodland		
Mixed Spruce-Birch Woodland	*Betula papyrifera*-*Picea glauca*/*Alnus sinuata*-*Salix novae-angliae*/*Calamagrostis canadensis* Paper birch-white spruce/Sitka alder-tall blueberry willow/bluejoint reedgrass	Mutnala (Typic Cryorthods)[2] Talkeetna (Humic Cryorthods) Spenard (Sideric Cryaquads)[2] Jacobsen (Histic Cryaquepts)
Needleleaf Black Spruce Woodland	*Picea mariana*/*Vaccinium uliginosum*-*Empetrum nigrum*/*Rubus pedatus*-*Equisetum arvense* Black spruce/bog blueberry-black crowberry/five-leaf bramble-field horsetail	Starichkof (Fluvaquentic Borochemists)
Shrubland		
Closed Tall Alder Shrub Scrub	*Alnus tenuifolia*-*A. sinuata*/*Calamagrostis canadensis*-*Polypodium* sp. Thinleaf alder-Sitka alder/bluejoint reedgrass-polypody fern	Kliskon (Typic Cryaquods)[2] Talkeetna (Humic Cryorthods)
Open Tall Willow Shrub Scrub	*Salix novae-angliae*-*S. planifolia*/*Calamagrostis canadensis*-*Rubus arcticus* Tall blueberry willow-diamondleaf willow/bluejoint reedgrass-nangoonberry	Kliskon (Typic Crgaquods) Talkeetna (Humic Gryorthods)
Open Low Sweetgale Shrub Scrub/Grass Fen	*Myrica gale*/*Carex aquatilis*-*Eleocharis palustris* Sweetgale/water sedge-spikerush	Starichkof (Fluvaquentic Borosaprists)
Herbaceous		
Mesic Graminoid Bluejoint Herbaceous	*Calamagrostis canadensis*-*Epilobium angustifolium*-*Equisetum arvense* Bluejoint reedgrass-willow weed-field horsetail	Mutnala (Typic Cryorthods)[2] Talkeetna (Humic Cryorthods) Killey & Moose River (Typic Cryaquents)

[1] Follows Viereck et al. (1982).

[2] These soil types were not mapped within the lease area.

Source: ERT 1984g.

TABLE 4-3

CHARACTERISTICS OF THE MAJOR SOIL UNITS OF THE DIAMOND CHUITNA PROJECT AREA

Soil Unit	Major Profile Characteristics	Drainage	pH
Talkeetna Variant	Deep (to 1.5 m [60 in]) sandy loams with volcanic ash overlying gravelly glacial till on morainic uplands	Well	4.2-4.6
Killey Series	Silt loam in alluvial sediments overlying gravelly substrata, 76-102 cm (30-40 in)	Poor	Acidic
Moose River Series	Stratified coarse alluvium over sandy - gravelly substrata (102 cm [40 in])	Poor	Acidic
Jacobsen Series	Deep (86 cm [34 in]) fine to coarse sand over glacial till mixed with volcanic ash; very acidic	Poor	3.8-4.7
Chichantna Series	Deep (66 cm [26 in]) peat w/ coarser peat volcanic ash inclusions, interbedded coarse sand at depth	Poor to very poor	5.3-4.7
Starichkof Taxadjunct	Moderately decomposed coarse and fine peat with interbedded volcanic ash	Very poor	5.1-3.9
Cryaquents-Histosols Complex	Cryaquents-stratified sand, sandy loams and silt loams overlying coarse sand and gravel alluvium	Poor to very poor	
	Histosols-deep peat, mucky peat and muck with some stratified mineral inclusions	Very poor	Acidic

cover) deciduous stands, or a mixture of deciduous and coniferous species. (Scientific names of dominant plant species as determined by mean foliar cover percentage are listed in Table 4-2.) Open broadleaf balsam poplar forests occur primarily on alluvium of stream channels. White spruce usually occurs as young trees or seedlings in the understory of this community (ERT 1984g). A similarly structured community is formed by paper birch on upland slopes and knolls. Again, white spruce is apparent in the understory. A more advanced stage in the paper birch to spruce succession is represented by a mixed white spruce-black spruce and paper birch woodland community. This type is associated with upland knolls and slopes and is abundant throughout the project area.

Woodlands (less than 25 percent tree cover) are found near black spruce on the perimeter of fens and sphagnum bogs on poorly drained soils. A mixture of white spruce and paper birch forms a second woodland community, but on uplands and slopes that have been disturbed (e.g., burned). This community is especially prominent north of the Chuitna River.

Alder thickets and willow stands are a conspicuous component of the vegetation in the project area. Thinleaf and Sitka alders form a dense tall shrub community on upland knolls and steep slopes, especially above 200 m (656 ft) elevation. A second tall shrub community is formed by tall blueberry willow and diamondleaf willow along the major stream courses of the area.

Low shrub-grass fen vegetation of sweetgale and sedges occurs as part of the muskeg-bog complex on poorly drained soils. This vegetation is scattered throughout the project area but is especially prominent south of the Chuitna River. A bluejoint grassland community is associated with openings in the white spruce-paper birch forest that has resulted from logging and beetle kill of trees (ERT 1984g). This community is considered early successional and is rich in herbaceous flora (Table 4-2). Logging activity has been especially prominent south of the Chuitna River, although recent harvesting has also occurred north of the river (ERT 1984g).

4.3.2.2 Threatened and Endangered Plant Species

No threatened or endangered plant species are known to occur in the vicinity of the Diamond-Chuitna project area (U.S. Fish and Wildlife Service 1984). Furthermore, no candidate threatened, endangered, or rare plant species is known to occur in this area (Murray 1980).

4.3.2.3 Wetlands

It has been nationally recognized that wetland habitats are a particularly valuable ecological resource and an integral part of regional hydrological regimes. Because of these special values and vulnerability to development activity, wetlands were granted special regulatory status via Section 404 of the Clean Water Act of 1977. The U.S. Army Corps of Engineers has been delegated the responsibility of regulating the discharge of dredged or fill material into wetlands. Wetlands are treated as a separate section in this report in order to emphasize their special values. The regulatory definition of wetlands found in 33 CFR 323.2 Para. c is as follows:

> "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

Wetlands within the project area have been mapped as part of the National Wetland Inventory Program (USFWS 1984). More detailed maps of wetlands within the southern transportation corridor, Granite Point port site, and 10-year mine permit area were developed by ERT (1984g). Wetlands in the eastern/Ladd transportation corridor, 30-year permit area and the northern transportation corridor were mapped by ERT (1986, 1987). They identified nine wetland types (Table 4-4). The percentage of total surface area covered by wetland communities within the study area has not been precisely determined, but is probably in the range of 20 to 30 percent. Of the nine wetland types identified by ERT, open low shrub scrub/sweetgale grass fen was the most common, especially south of the Chuitna River, where it comprised nearly 50 percent of total wetlands. Open mixed forest wetland occupied 30 percent in this area, with seven other types comprising the remaining 20 percent. North of the Chuitna River, open mixed forest wetland appeared more common than open low shrub scrub/sweetgale fen, although both clearly were more dominant than any other wetland type.

Bogs composed of a complex of the above palustrine* wetland types are common within the study area. Typically, the wetter areas are characterized by various proportions of emergent grasses and sedges and woody shrubs which grade into forested wetland types at the edge of the muskeg areas. Often open water areas are present near the center of the wetland depressions. Estuarine salt marsh and mud flat wetland types are not present within the study area but do exist in the adjacent Trading Bay State Game Refuge.

Table 4-4

WETLAND CHARACTERISTICS IN THE MINE LEASE AREA, SOUTHERN TRANSPORATION CORRIDOR, AND PORT AREA[3]

FWS Symbol[1]	System Class Subclass[2]	Dominant Vegetation[3]	Water Regime
PF04/1	Palustrine Forested Mixed needle-leaved evergreen/broad-leaved deciduous	Open Mixed Forest/Spruce Birch;Mixed Woodland/Spruce Birch	saturated to semi-permanently flooded
PF04	Palustrine Forested Needle-leaved evergreen	Needle-leaf Woodland/Black Spruce	saturated to semi-permanently flooded
PSS1	Palustrine Scrub/Shrub Broad-leaved deciduous	Open Tall Shrub Scrub/Willow; Closed Tall Shrub Scrub/Alder	saturated to semi-permanently flooded
PSS1/EMS	Palustrine Scrub/Shrub Broad-leaved deciduous Emergent Narrow-leaved Persistent	Open Low Shrub Scrub/Sweet-gale-Grass Fen	saturated to semi-permanently flooded
PEMS	Palustrine Emergent Narrow-leaved Persistent	Mesic Graminoid Herbaceous/ Bluejoint-Herb	saturated to semi-permanently flooded
R3OWH	Riverine Upper perennial Open water	--	permanent
L1OWH	Lacustrine Limnetic Open water	--	permanent
L2AB4H	Lacustrine Littoral Aquatic Bed Floating-leaved	*Utricularia* spp., *Sphagnum* spp., *Nuphar* spp., *Nymphaea* spp., *Potamageton* spp.	permanent
POWH	Palustrine Open water	*Utricularia* spp., *Sphagnum* spp., *Nuphar* spp., *Nymphaea* spp., *Potamageton* spp.	permanent

---

[1] Symbols conform to those used in National Wetlands Inventory (U.S. Fish and Wildlife Service 1981)

[2] Cowardin et al. 1979

[3] Adapted from ERT 1984g

Based on federal regulations (40 CFR 230) and scientific analysis, wetland values in the project area are viewed in four broad categories. The following is a discussion for each of the value categories in order to provide a basis for assessing the wetland impacts that could result from the proposed activities.

Food Chain Production

Some kinds of wetland communities are known to produce large quantities of plant matter compared to other biological systems (Darnell et al. 1976). However, the isolated palustrine wetlands characteristic of the study area cannot be considered highly productive and probably have a lower net primary productivity* than the adjoining upland forests (Good et al. 1978). Nevertheless, these wetlands contribute substantially to the net production of organic matter that supports other ecosystem components. The plant matter produced enters the food web in a number of ways. Some animals such as insects and other invertebrates, bears, moose, and waterfowl feed directly on the vegetation. A portion of the vegetation, especially in the emergent sedge/grass communities, dies and becomes part of a decomposing mass which is consumed by bacteria and fungi which in turn is fed upon by invertebrates. Cones produced by the black spruce communities at the edges of the bogs provide a specific food source for red squirrels (Tamiasciurus hudsonicus) and some birds.

Habitat for Land and Aquatic Species

The wetland habitats within the study area provide openings and habitat diversity within the predominantly forested terrain and consequently enhance the value of the area to key species such as moose (Alces alces) and black bear (Ursus americanus). Ponds within the wetland depressions contribute some limited habitat for waterfowl. Sandhill cranes (Grus canadensis) as well as some shorebirds and songbirds utilize the muskeg areas for nesting and feeding.

Hydrology and Water Quality

Wetlands within the study area play an important role in the storage of water and the recharge of shallow groundwater aquifers (ERT 1984c). Water held in the deep organic material contributes to surface water flow in local streams. This storage capacity tends to buffer surface runoff and moderate stream flows. Enhanced winter stream flows due to ground-water input and moderate peak flows are important to successful fish production in the Chuitna River and other drainages.

Marsh and muskeg wetlands can contribute to flow of nutrients within freshwater and marine environments.

Chemical reactions that occur during the process of decay within organic matter underlying wetlands cause nutrients such as nitrogen and phosphorous to be released into the water. Surface drainage distributes these nutrients to aquatic habitats. Wetlands also serve to purify waters of some trace elements and organic compounds by accumulation within the organic matter.

Recreational Use

Recreational use of wetlands within the Diamond Chuitna project area is low and incidental to area-wide activities such as moose hunting. Coastal wetlands south of the project area in Trading Bay State Game Refuge receive some use by waterfowl hunters. The limited access and subsistence orientation of local residents precludes heavy recreational use.

4.3.3 Wildlife

4.3.3.1 Birds

Three groups of birds are of particular interest in the project area: waterfowl, shorebirds, and raptors.

Waterfowl

Although it is flanked by important waterfowl breeding and migration areas on the south (Trading Bay State Game Refuge) and the east (Susitna Flats State Game Refuge), the project area itself contains relatively poor breeding and staging habitat for ducks and geese. Only a small area northeast of Congahbuna Lake and the bog area west of the Beluga Power Station provide significant habitat for breeding ducks (ERT 1983). During spring and fall migration, waterfowl (mainly mallards, greenwinged teal, and pintails) occur in fair numbers at the mouth of the Chuitna River and on mudflats east of the Beluga airstrip. However, neither area appears to be significant compared to other areas utilized by migrating waterfowl in Cook Inlet (ERT 1986, 1987).

The Tukallah Lake area supports moderate numbers of waterfowl during the summer but is not used during spring migration because it remains frozen longer than the Beluga Flats area. Common mergansers, scaup, shovelers, bufflehead, goldeneyes, gadwalls, wigeons, and mallards have been observed feeding in the area after breakup. The area is also used to some extent for resting and feeding during fall migration (ERT 1987).

The project area is of minor importance to migrating trumpeter swans (Olor buccinator), but it is bordered by important resting and feeding areas used during migration. The mine permit area and the upper portions of all transportation corridor options are seldom frequented by trumpeter swans, but one active nest site was found in 1983 adjacent to the Chuitna River crossing in the proposed southern transportation corridor (Fig. 4-2). The lower portion of the southern corridor falls within a broad band of swan nesting habitat that stretches from the Beluga River to Nikolai Creek, extending inland approximately 8 km (5 mi) from Cook Inlet (Fig. 4-2). This area includes 50 percent of the swan nesting sites within the Beluga Region (ERT 1984f). Surveys in 1986 revealed that better swan nesting habitat and greater swan use occurs north of the Chuitna River rather than along the river itself (ERT 1986).

Surveys in 1987 (ERT 1987) identified two swan nests within 1 mile of the proposed northern/Ladd corridor. One nest was located near the northern end of Tukallah Lake and the other was near Threemile Creek (Fig. 4-2). Swans also use the area north of the northern/Ladd corridor for molting and during migration. Nesting does not appear to occur west of Threemile Creek (ERT 1987).

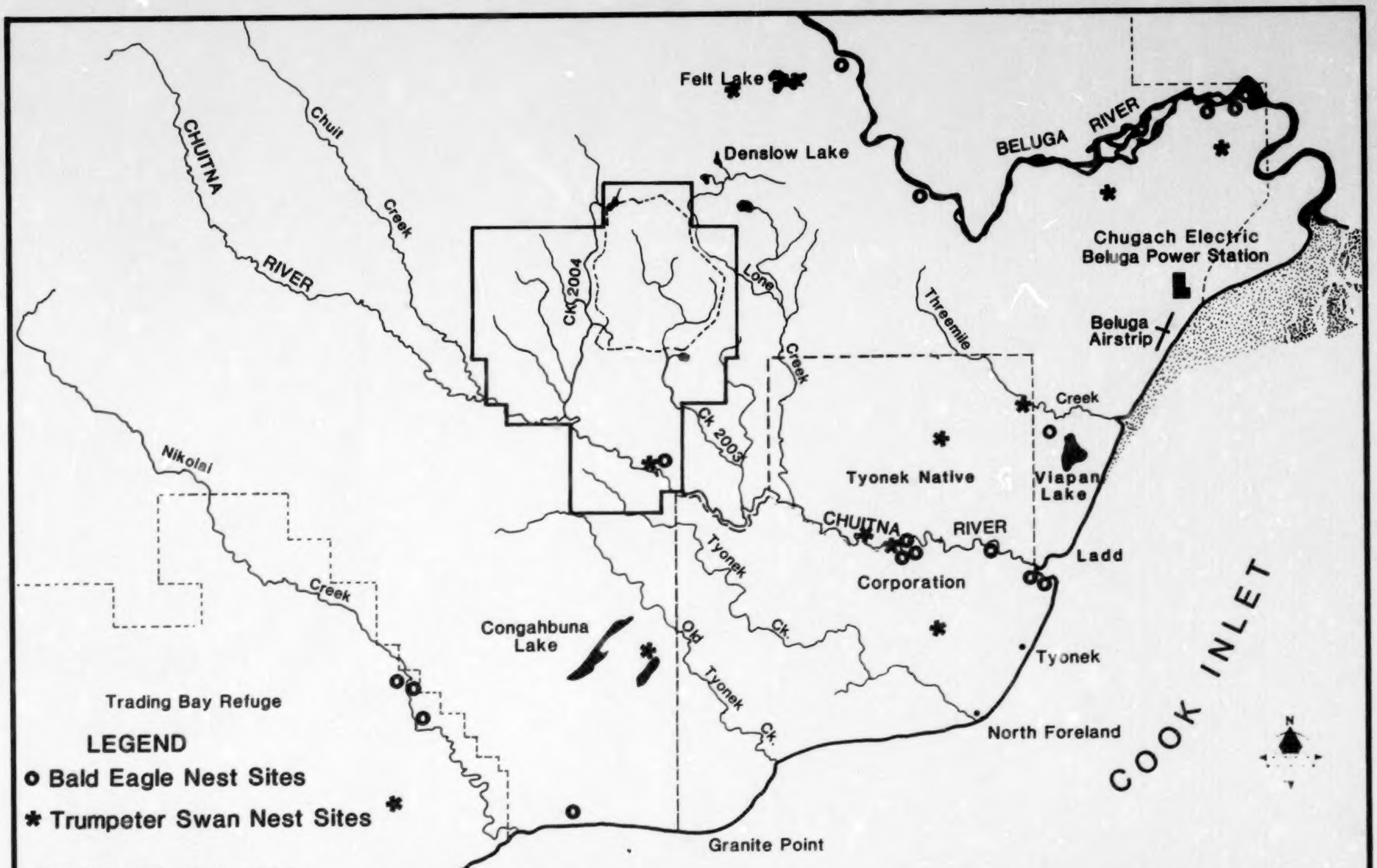
With the exception of the portion of the southern transportation corridor option just north of Granite Point, the project area is not important for sandhill cranes (Grus canadensis). The area north of Granite Point may support two or three breeding pairs (ERT 1984f). There have been many sightings of cranes in Trading Bay State Game Refuge where a breeding pair was reported in 1981 (DOWL 1981).

Shorebirds

The project area itself is not important for migrating or breeding shorebirds or other waterbirds, but is bordered by important migration areas. The mudflats between Granite Point and Nikolai Creek, just west of the proposed Granite Point port area, are very important for migrating shorebirds (ERT 1984f). Migrating shorebirds are common at the mouth of the Chuitna River and on the mudflats east of the Beluga airstrip (ERT 1986); they are uncommon at the proposed Ladd portsite (ERT 1987).

Raptors

The most common raptor in the project area is the bald eagle (Haliaeetus leucocephalus). Eagles are found along the coast and the Chuitna River as far upstream as Chuit Creek during the spring, summer, and fall. They are less common along the major tributaries of the Chuitna in the mine permit area, but are regularly seen there feeding on dead salmon during the July through October spawning period (ERT 1984f).


Felt Lake
Denslow Lake
BELUGA RIVER
Chugach Electric Beluga Power Station
Beluga Airstrip
CHUITNA RIVER
Chuit Creek
Ck 2004
Lone Creek
Threemile Creek
Ck 2003
Tyonek Native Corporation
Viapan Lake
CHUITNA RIVER
Ladd
Nikolai Creek
Tyonek Ck.
Old Tyonek Ck.
Congahbuna Lake
Tyonek
COOK INLET
North Foreland
N
Trading Bay Refuge
Granite Point
LEGEND
o Bald Eagle Nest Sites
* Trumpeter Swan Nest Sites

SOURCE: ERT 1984, 1986

BALD EAGLE AND
TRUMPETER SWAN NEST SITES

Diamond Chuitna Environmental Impact Statement

FIGURE 4- 2

Within the study area, 16 bald eagle nests have been located on or near three major waterways (Fig. 4-2). Seven nests are located on the Beluga River (only four of which are within the area depicted in Fig. 4-2), seven on the Chuitna River, four are on or near Nikolai Creek, and one is on the east side of Tukallah Lake. Only two nests, one on the north side of the Chuitna River near the proposed southern transportation corridor crossing and the second on the east side of Tukallah Lake, are located within the project area itself (Fig. 4-2) (ERT 1984f; Dalton 1987).

Passerines

Songbird habitat in the project area (including the transportation corridors and proposed port site) is typical of that found throughout southcentral Alaska. Common species include Swainson's thrush, alder flycatcher, ruby-crowned kinglet, orange crowned warbler, yellow-rumped warbler, blackpoll warbler, and dark-eyed junco. Most of these species nest in the area, particularly in spruce/birch forest and wet meadow habitats.

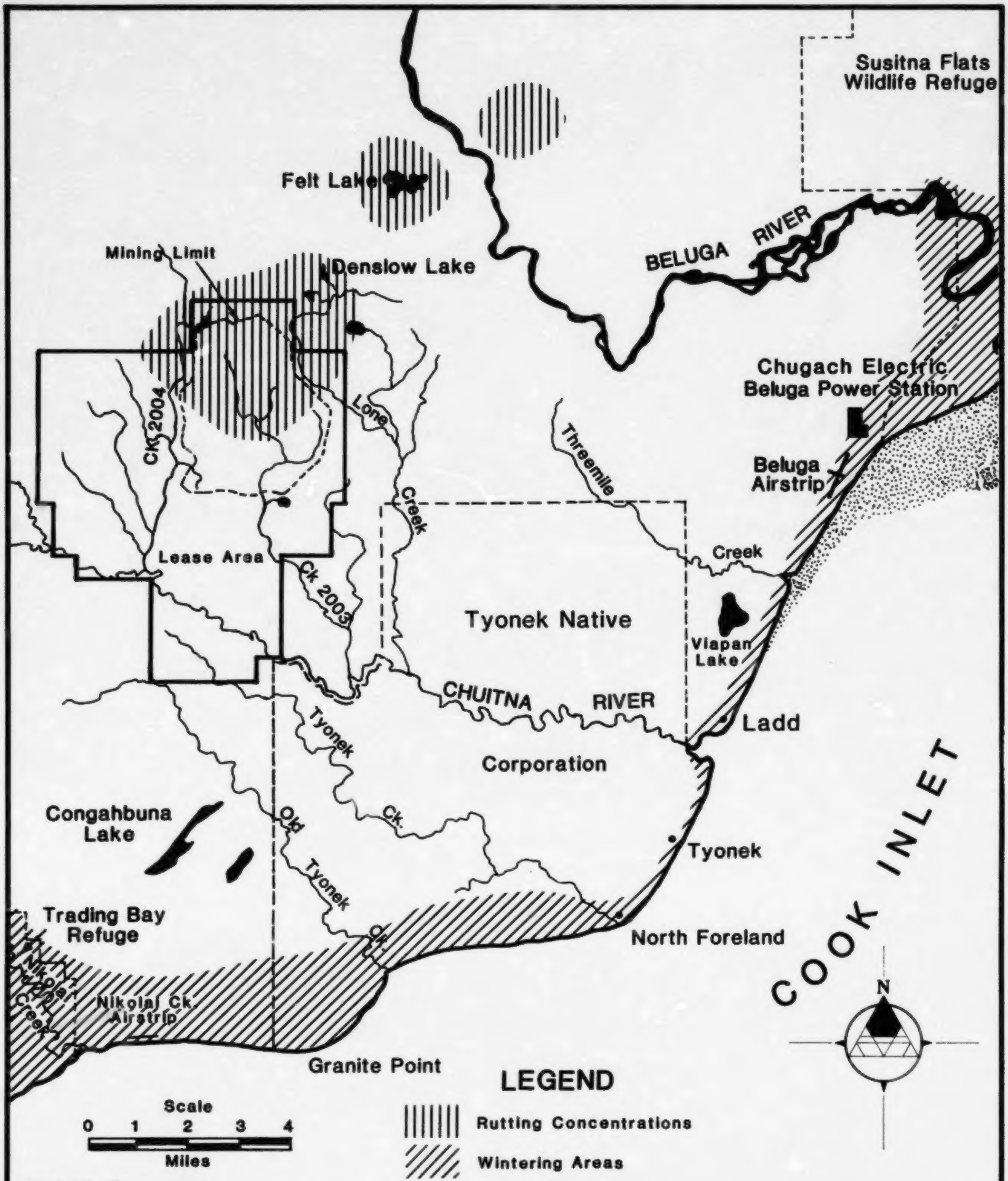
4.3.3.2 Mammals

Four species of mammals are of particular concern in the project area because of their economic, ecological, or cultural importance: moose (Alces alces), brown bear (Ursus arctos), black bear (Ursus americanus), and beaver (Castor canadensis).

Moose

Moose are common throughout the study area in spring, summer, and fall. Most calving takes place between the middle of May and the middle of June in the lowland bog and open, mixed spruce/hardwood communities below 152 m (500 ft). A majority of cows with calves remains in the area all summer because of the abundant vegetation. During that period, a sizable portion of the population, primarily bulls and cows without calves, follows the receding snowline to the open upland shrub/tundra communities above timberline (above 381 m [1,250 ft]). These animals remain there until forced down to lower elevations near the coast and along the main stem of the Chuitna River by deep snow in November and December (ERT 1984f).

During the breeding season (the rut) which occurs in October and November, relatively large numbers of moose concentrate in rutting areas at the higher elevations in the project area. One such rutting area is located south of Lone Ridge in the vicinity of Denslow Lake and the northern portion of the permit area (Fig. 4-3) (Faro 1985a). Moose in these rutting areas gather in small groups which stay in the area throughout the breeding season. Detailed habitat characteristics of moose rutting areas are not fully understood or defined in current scientific literature.


Susitna Flats
Wildlife Refuge
Felt Lake
Mining Limit
Denslow Lake
BELUGA RIVER
Chugach Electric
Beluga Power Station
Beluga
Airstrip
Ck 2004
Lone
Creek
Threemile
Creek
Lease Area
Ck 2003
Tyonek Native
Corporation
Viapan
Lake
CHUITNA RIVER
Ladd
Tyonek
Ck.
Congahbuna
Lake
Old
Tyonek
Ck
Tyonek
North Foreland
COOK INLET
Trading Bay
Refuge
Nikolai
Creek
Nikolai Ck.
Airstrip
Granite Point
N
LEGEND
Rutting Concentrations
Wintering Areas
Scale
0 1 2 3 4
Miles

SOURCE: Faro 1984

MOOSE RUTTING CONCENTRATIONS (OCT.'83)
AND WINTERING AREAS (FEB.'84)

Diamond Chuitna Environmental Impact Statement | FIGURE 4- 3

However, the moose monitoring study which will be conducted by ADF&G according to the ASMCRA permit will provide greater understanding of the attributes of moose breeding habitat. ADF&G will conduct a three year telemetry study two years prior to mine construction. This study will be supplemented with aerial population surveys and fall trend counts that ADF&G believes will be sufficient to answer questions about the Lone Ridge moose rutting area.

In late winter, moose concentrate in the lowland flats on the south side of the Beluga River for a distance of approximately 16 km (10 mi) upriver from the mouth (Fig. 4-3). Moderate numbers of moose appear to inhabit a 3.2 to 6.4 km (2 to 4 mi) wide band stretching south from the mouth of the Beluga River along the coast of Cook Inlet to the vicinity of the Nikolai Creek escarpment and Congahbuna Lake. Small numbers of scattered moose range upstream to above the confluence of Chuit Creek in the riparian* willow habitats along the main stem of the Chuitna River. Small numbers are also found along most of Lone Creek and in the lower 3.2 to 4.8 km (2 to 3 mi) of Stream 2003. There appears to be little late winter use of the mine permit area by moose (ERT 1984f).

Moose wintering in the vicinity of Granite Point appear to spend a major portion of other seasons within the project area, including the mine permit area (Faro 1985a). A winter moose census within the study area in February 1984 estimated a population of 792 moose within the 1,343 km^2 (518.5 mi^2) area between the Beluga River and Nikolai Creek, or approximately 0.6 moose per km^2 (1.5 moose per mi^2) within the study area (Faro 1985a).

Brown Bear

Brown bears may be found throughout the study area during the spring, summer, and fall. They are likely to be found in any vegetative cover type, but generally prefer open habitats and are most common in the upland shrub and tundra communities. Brown bears are not as common in the lowlands adjacent to Cook Inlet as are black bears (ERT 1984f).

Food availability significantly influences brown bear distribution in the study area. Emerging grasses and herbaceous plants are critical to bears during the late spring period after leaving their dens and during early summer. From late July until as late as October, the availability of spawning salmon draws bears to the streams, often over long distances. The main stem of the Chuitna River within the project area is used very little by bears. The three major tributaries in or adjacent to the mine permit area (Lone Creek and streams 2003 and 2004), however, show substantial use by bears feeding upon salmon (ERT 1984f). In general, brown bears tend to predominate in the more open mid-level sections of these creeks while in the lower, more brushy and timbered portions, black bears appear to be more common. However, both species feed upon salmon in both areas. Seasonally, bears seem to be dispersed along the meandering, mid-elevation sections of the three creeks with no particular concentration areas identified (ERT 1984f).

In late July, berries become available and may constitute the bulk of the diet, particularly in years of heavy crops. Ripe berries can often attract bears away from accessible and abundant supplies of salmon (Erickson 1965).

Brown bears enter their dens in October or November depending upon the onset of winter. Dens are usually located at higher elevations and bears remain there until late April or May. No specific information is available on den site distribution nor does any accurate estimate exist for the size of the brown bear population in the study area. The brown bear population appears to be typical for relatively undisturbed coastal areas in southcentral Alaska.

Black Bear

Black bears may be found throughout the study area at any time of year, but they seem to prefer open, mixed hardwood/spruce forests at the lower elevations between Cook Inlet and timberline. They are commonly seen along streams and in and around bogs and clearings. Black bears do not appear to spend much time above timberline in the study area.

They generally eat the same spring and early summer herbaceous plant species as described above for brown bear, but they use a greater diversity of species. In early May, black bears feed on the emerging green vegetation found around water seeps at the base of the bluff on the north side of the canyon on the main stem of the Chuitna River (ERT 1984f). Also, black bears may be significant predators on moose calves in late spring (Miller and McAllister 1982).

Major factors affecting summer and fall black bear distribution are the abundance and distribution of berries and salmon. Since much of the salmon spawning takes place at lower elevations within their home ranges, black bears in the study area probably travel shorter distances to the streams than do brown bears (ERT 1984f). Black bears are found at lower elevations in the fall than are brown bears; denning probably also occurs at lower elevations in the mixed spruce/hardwood forests. No accurate estimate exists for the size of the black bear population in the study area, but it is probably relatively high.

Beaver

Beaver are widely distributed in the study area, from lowlands near Cook Inlet to the upland tundra/shrub communities at 503 m (1,650 ft) on top of Lone Ridge. They are most common along the major tributaries of the Chuitna River that have a low gradient (Lone Creek and streams 2003 and 2004) and in sloughs and backwater areas along the main stem of the Chuitna (Fig. 4-4). Beaver dams are a very important influence on the distribution of spawning and rearing salmon in the Chuitna River tributaries of the project area (ERT 1984f).

Beaver cache* counts show that Lone Creek has the highest number (0.70) of caches per km (1.13 per mi) of the tributary streams within the project area, followed by Stream 2004 with .49/km (.79/mi) and Stream 2003 with .26/km (.43/mi). The Lone Creek and Stream 2003 drainages also have several active lake colonies (ERT 1984f).

Two beaver colonies are located on Old Tyonek Creek within or immediately adjacent to the southern transportation corridor option and two more colonies exist on the large lake 1.6 km (1.0 mi) southeast of Congahbuna Lake. There are no known colonies on Tyonek Creek within the southern corridor nor in the Granite Point port area. Ten active beaver colonies occur just north of the Chuitna River (ERT 1986).

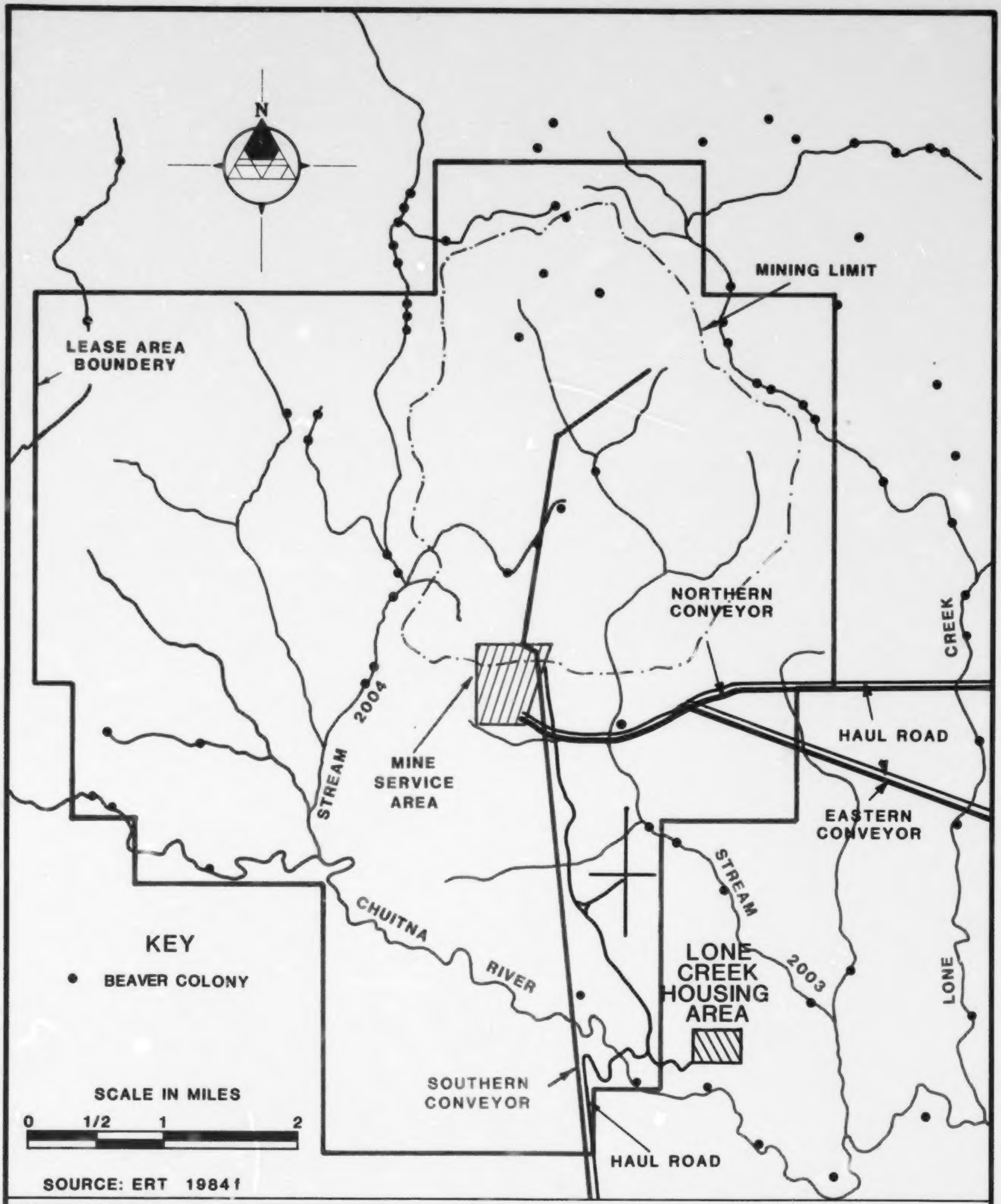
Beaver are common in the northern/Ladd corridor area although no beaver colonies were located within 1.6 km (1.0 mi) of the proposed Ladd port site. Nine active beaver colonies occur within 1.6 km (1.0 mi) of the North Road, one of which is on Threemile Creek downstream from the proposed road crossing. The other eight colonies are on small lakes (ERT 1987).

4.3.3.3 Threatened and Endangered Species

Use of the study area by threatened or endangered wildlife has not been documented. The only endangered species which may be found in the area is a subspecies of the peregrine falcon (Falco peregrinus anatum). The project area is at the extreme southern end of the range of this species and no suitable habitat nor any individuals have been located by surveys (ERT 1984f).

4.3.4 Habitat Value and Sensitivity

A habitat mapping and evaluation study was conducted specifically for this EIS to provide a basis for comparing habitat impacts from project alternatives as well as comparing pre- and postproject habitat values. Specific evaluation species were selected that have high public interest or serve as indicator species for habitats having


N
LEASE AREA
BOUNDERY
MINING LIMIT
NORTHERN
CONVEYOR
CREEK
HAUL ROAD
EASTERN
CONVEYOR
STREAM 2004
MINE
SERVICE
AREA
STREAM
2003
LONE
CREEK
HOUSING
AREA
LONE
CHUITNA
RIVER
KEY
● BEAVER COLONY
SCALE IN MILES
0
1/2
1
2
SOUTHERN
CONVEYOR
HAUL ROAD

SOURCE: ERT 1984f

MINE AREA BEAVER COLONIES (OCTOBER 1983)

Diamond Chuitna Environmental Impact Statement

FIGURE 4-4

significant ecological value. Evaluation species were moose, brown bear, black bear, trumpeter swan, and sandhill crane. Methods and results of the analysis are summarized below and presented in detail in Appendix A.

The habitat value categories used in the analysis (Appendix A, Table 1) roughly correspond with categories in the USFWS Mitigation Policy (FR Vol. 46 No. 15, 23 Jan. 1981). In general, none of the habitats in the project area would be considered to have "very high" value (unique and irreplaceable) relative to the key species. However, some habitats with values in the "high" range are present.

Mapping of moose spring/summer/fall range (Appendix A, Fig. 7) indicates that the mixed woodland/muskeg terrain that covers the area is predominately medium quality with scattered areas of high quality shrub habitat in some riparian and adjoining zones, especially in the vicinity of Old Tyonek Creek. Moose winter habitat (Appendix A, Fig. 9) is limited by snowfall to the southwest portion of the study area at elevations less than 152 m (500 ft). Within this lower elevation area, winter habitat value is primarily medium with some scattered high quality areas interspersed. It should be noted that the Appendix A habitat evaluation is based on habitat characteristics rather than actual animal distribution. Moose studies have indicated that winter concentrations occur along the coast (Fig. 4-3) within habitats rated from low to high value. Therefore, impact analyses should consider both animal distribution and modelled habitat value when assessing impact significance.

According to the models used in Appendix A, nearly all of the study area provides high quality habitat for both black and brown bears (Appendix A, Fig. 5). A few scattered areas of medium quality brown bear habitat are also present.

Sandhill cranes represent a somewhat different situation. Little information is available upon which to base habitat ratings. The study area was divided into suitable and unsuitable (not utilized) areas (Appendix A, Fig. 1). All suitable areas were considered to have high value for cranes. Suitable areas are scattered throughout the southwest portion of the study area within selected wetlands at elevations below 152 m (500 ft).

Trumpeter swan nesting habitat is limited to lakes. Lakes within the study area are rated as high, medium, or low value swan habitat (Appendix A, Fig. 3). High quality lakes are primarily north of the Chuitna River at lower elevations.

From the standpoint of sensitivity to impacts from development, high quality habitats that exist in limited quantity would generally be considered most vulnerable since disturbance of a relatively small area could affect a substantial percentage of the available habitat. On this basis, trumpeter swan nesting lakes and moose winter range would probably be considered the most sensitive habitat types relative to the evaluation species considered in Appendix A. Additionally, nesting swans are exceptionally sensitive to human disturbance and habitat value is readily lost if humans are present (Timm 1981).

4.4 FRESHWATER ENVIRONMENT

4.4.1 Ground-water Hydrology

Detailed information on the ground-water hydrology of the area can be found in the baseline study report (ERT 1984c). The following discussion summarizes the results of that study.

Ground water within the Diamond Chuitna project permit area can be categorized in seven hydrogeologic units. These units are distinct but interrelated. Ground water within the units is either confined* or unconfined. Starting with those closest to the surface the units are described as follows:

- Recent Alluvium - Consists of the sands and gravels within the present stream channels. The sands and gravels usually have high permeability and ground water is in an unconfined aquifer.
- Overburden - Consists of unconsolidated surficial deposits composed of glacial tills, drift and outwash and the upper part of the Tyonek Formation composed of semi-consolidated clays and sandy silts with some silty sands and coal stringers. The Tyonek Formation is separated from the surficial deposits by an erosional unconformity. Ground water within the overburden is unconfined with locally confining conditions within the Tyonek Formation due to silt and clay beds.
- Blue Coal - Minable coal seam which is discontinuous throughout the area due to erosion. Ground water in this unit is confined.
- Red 3 Seam - A minable coal seam, also discontinuous throughout the permit area due to erosion. This layer is saturated with water and exists under confined conditions.
- Red 2 Seam - Minable coal seam which underlies most of the site, except a few areas where removed by erosion. Ground water in the unit is confined.
- Red 1 Seam - A minable coal seam which is continuous throughout the permit area. The layer is saturated and exists under confined conditions.

- Sub Red 1 Sand - A thick sandstone unit which is overlain by the Red 1 Underclay. The unit is continuous throughout the permit area and is saturated under confined conditions.

The interburden layers between the coal seams and the Sub Red 1 Sand generally act as confining tiers, or aquitards, between the hydrogeologic units. The confining properties of the layers are variable due to sandy zones within the units and hydraulic connections between the coal seams resulting from erosion. The Red 1 Underclay appears to be more homogeneous than other interburden units, forming an effective continuous aquitard over the Sub Red 1 Sand. The interburden units themselves are not considered aquifers or hydrogeologic units of interest because of their low transmissive properties (relative to the coal seams or overburden); however, localized areas within the interburden may be more permeable than the adjoining coal seams.

Transmissivity, i.e., the rate at which water flows through an aquifer, and the thickness of each hydrogeologic unit are listed on Table 4-5. The hydrogeologic units have variable transmissivities due to differences in the physical characteristics of the rocks or the amount of fracturing within the unit.

Hydraulic characteristics of the overburden and the alluvial deposits are highly variable and nonhomogeneous due to the variability of materials within these units, (i.e. gravels, sands, silts, and clays) and complexity of the depositional environments. The overburden is recharged primarily by direct precipitation and stores significant quantities of water due to its thickness and porosity. Ground water in the overburden aquifer discharges to streams, providing approximately 89 percent of the estimated baseflow, and to stratigraphically lower aquifers, including the coal seams.

The Red 3 Seam, Red 2 Seam, and Red 1 Seam are all considered to be low permeability aquifers. The ground-water storage capacity and permeability on the coal seams are controlled by the fracture patterns (secondary porosity) of each unit. Thus, in general, the amount of water that can freely drain is probably small compared to the overburden. Recharge to the coal units occurs by direct precipitation where the units are exposed by erosion, by contact with saturated overburden aquifers, and by leakage through the interburden units. The coal seam aquifers and other water bearing units in the Tyonek Formation provide approximately 11 percent of estimated baseflow to streams.

The Sub Red 1 Sand aquifer underlies the entire permit area and lies below the coal seams. This aquifer is confined by the overlying Red 1 Underclay and appears to be hydraulically separated from the overlying Tyonek and overburden units within the permit area. This aquifer does not contribute to stream baseflow in the permit area.

Ground-water flow is controlled by both the local topography and by the region's structural geology. The irregular topography provides for surface-water collection and for ground-water recharge* into the underlying alluvium or overburden unit. Ground-water discharge to the stream channels occurs where the channel has cut below the local ground-water piezometric* surfaces. Folding in the Tyonek Formation combined with the erosional unconformity at its surface has resulted in the formation of several discharge and recharge boundaries, e.g., folding or erosional breaks permit water exchange with the surface or the overburden unit (ERT 1984c). Ground-water flow in the surficial overburden unit and recent alluvial units is predominantly from higher elevations to lower elevations in the stream valleys where ground water is discharged. Ground-water flow in the remaining hydrogeologic units is predominantly from west to east.

Faulting within the Tyonek Formation (Chuit Fault in the northwest part of the permit area and the South Pit Fault in the southern part of the permit area) act as barriers to ground-water flow; however, evidence suggests that leakage occurs across these barriers (ERT 1984c) (Figure 2-4). The presence of these fault barriers essentially limit the recharge area and extent of the ground-water storage reservoir within the Tyonek Formation (coal seam aquifers). The faults will not have an impact on the alluvial and unconsolidated glacial deposits in the overburden because these units continuously overly the faulted consolidated Tyonek Formation.

During pit dewatering, the ground-water barriers may increase the efficiency of dewatering the coal units by limiting the extent of the potential reservoir in each coal seam aquifer. Thus, if pumping from the coal seams exceeds natural recharge, the available ground water stored in these units will gradually be depleted once the cone of depression created by pumping reaches the flow barriers. The sustained yield in the coal seam aquifers will then equal the recharge rate, which is the quantity of water able to move across the ground-water barriers and by leakage from the overburden. This quantity is assumed to be relatively small. Portions of the South Pit Fault will be mined through during the period of the permit. This will increase water availability within coal units and the Sub Red 1 Sand offset by the fault, which are subsequently exposed by the destruction of the fault barrier.

Ground-water quality becomes poorer with depth in the various stratigraphic units (Section 4.4.3.1). The poorest water quality is found within the Sub Red 1 Sand and the alluvial and glacial deposits exhibits the highest water quality (Table 4-11). The Sub Red 1 Sand is the only aquifer which contains ground water below recommended drinking water standards due to excessive dissolved solids. The removal of portions of the South Pit Fault during mining would allow ground water from the Sub Red 1 Sand to enter the pit.

The quantity of water entering the pit from the Sub Red 1 Sand would be significantly diluted by water entering the pit from the overburden and coal unit aquifers overlying the Sub Red 1 Sand. The dilution effect would be expected to maintain water quality in the pit discharge water above drinking water standards. This conclusion was arrived at by assuming that the transmissivities in the Red 1 Coal, Red 2 Coal and the glacial deposits are represented by the lowest values reported for these aquifers in Table 4-5, and that the transmissivity of the Sub Red 1 Sand is represented by the highest value as shown in Table 4-5. The specific conductance of the ground water for each unit (ERT 1984c) was used to evaluate the dissolved solids in each aquifer contributing to the pit.

Table 4-5

AQUIFER CHARACTERISTICS

HYDROGEOLOGIC UNIT	TRANSMISSIVITY (gpd/ft)[3]	THICKNESS OF UNIT m(ft)
Recent Alluvium	3,000 to 50,000[1]	0- 12.2 (0- 40)
Overburden	155 to 250,000	0-152.5 (0-500)
Blue Coal	102 to 667	4.58(15)[2]
Red 3 Seam	96 to 624	4.58(15)[2]
Red 2 Seam	58 to 815	4.58(15)[2]
Red 1 Seam	29 to 300	4.58(15)[2]
Sub Red 1 Sand	86 to 1,850	9.15(30)

[1] Estimated.
[2] Average thickness.
[3] Reported in English units to correspond with hydrological convention.

Source: ERT 1984c.

An understanding of the interrelationships between ground water and surface water is critical in providing a basis for impact assessment. Ground water contributes 34, 32, and 30 percent to the annual flows of Lone Creek, Stream 2003, and Stream 2004, respectively (ERT 1984c). At least 90 percent of this ground water is derived from the shallow overburden aquifers; the deeper aquifers contribute little to streamflow within the mine area. Muskegs are important to ground-water recharge and storage within the shallow aquifers. The stored water recharges rapidly causing flow of water in surface deposits that are ultimately drained by streams at the valley bottoms. These shallow systems on the terraced sideslopes of the project area drainages provide the majority of base flow to streams (ERT 1984c).

4.4.2 Surface Water Hydrology

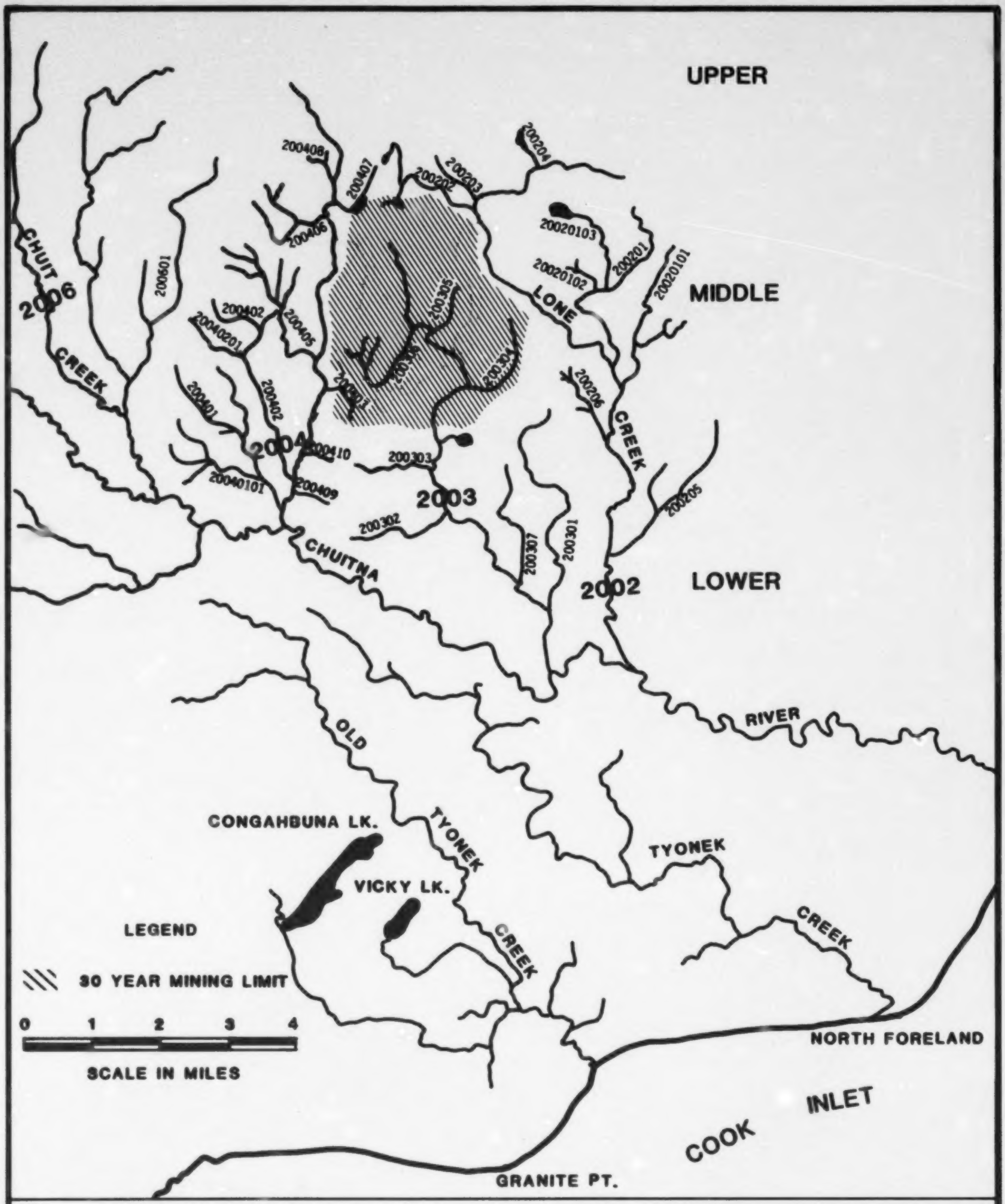
The area of possible hydrologic impacts related to the project extends from the headwaters of the Chuitna River on the northwest to Cook Inlet on the southeast and to Threemile Creek on the northeast (Fig. 4-5). Upstream of the project boundary, the Chuitna River is joined by Chuit Creek, Wolverine Creek, and a number of smaller unnamed tributaries. These streams will not be affected by the proposed development.

The Chuitna River flows along the southwest side of the project area and drains a glacier-free area of about 388 km^2 (150 mi^2) over a total flow distance of about 27 km (17 mi) from the northwest to southeast. Ground elevations in the basin range from sea level to approximately 549 m (1,800 ft). A short distance upstream of the project area, the streams are incised in a broad piedmont lowland that is covered with a thin mantle of poorly drained tundra vegetation.

North of the Chuitna River, the terrain is relatively flat with numerous ponds and small lakes. Larger lakes include Chuitbuna Lake, Viapan Lake and Tukallah Lake. The surface drainage in this area is poor; surface water runoff is generally to the east and south. Since the soils are nearly saturated, streams and ponds fill quickly during heavy rains (Riverside Technology, Inc. 1986).

The surface water bodies that could be affected by the proposed development include the Chuitna River and its tributaries in the vicinity of the mine area, Tyonek Creek and Old Tyonek Creek and their tributaries, and Threemile Creek. The drainage areas and estimated mean, minimum, and maximum flows of the potentially affected streams are shown in Table 4-6. Numerous lakes and ponds are also present in the study area including Congahbuna and Vicky lakes near the proposed southern corridor.

The average annual precipitation in the basin during the monitoring period 1982-83 has been estimated to be 122 cm (48 in) with evapotranspiration losses of 23 cm (9 in). Mean monthly temperatures range from a minimum of -17°C (1.5°F) in January to a maximum of 18°C (64°F) in July. In February 1983, the snow-course depth in the area varied from 58 cm (23 in) near Congahbuna Lake to 152 cm (60 in) on Chuitna Plateau, 162 cm (64 in) on Lone Ridge, and 229 cm (90 in) on Capps Plateau.


UPPER
MIDDLE
LOWER
CHUIT
CREEK
2006
200601
200408
200407
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200405
200402
20040201
200401
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2004
200410
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20040101
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200203
200204
20020103
20020102
200201
20020101
LONE
CREEK
200206
200205
2002
CHUITNA
RIVER
OLD
TYONEK
CREEK
TYONEK
CREEK
CONGAHBUNA LK.
VICKY LK.
LEGEND
▨ 30 YEAR MINING LIMIT
0
1
2
3
4
SCALE IN MILES
NORTH FORELAND
COOK
INLET
GRANITE PT.

WATERBODIES OF THE DIAMOND CHUITNA MINE STUDY AREA

Diamond Chuitna Environmental Impact Statement	FIGURE 4-5

Table 4-6

AFFECTED STREAMS

Stream	Location	Drainage Area km^2 (mi^2)	Estimated Flows m/sec (cfs) Instantaneous Minimum	Mean Annual	Instantaneous Maximum
1. Chuitna River (Sta. C045)*	Southwest of mine area	183.81(70.97)	0.75(26.61)	5.70(203.68)	118.72(4240.16)
2. Chuitna River (Sta. C120)*	Near conveyor crossing	130.12(88.85)	0.84(29.93)	7.79(278.28)	156.80(5600.13)
3. Chuitna River (Sta. C230)*	Downstream of affected mine area	342.48(132.23)	1.77(63.36)	10.26(366.30)	189.82(6779.11)
4. Lone Creek (Sta. C220)*	Above confluence with Chuitna River	49.78(19.22)	0.13(4.73)	1.36(48.40)	25.46(908.80)
5. Unnamed Tributary 2003 (Sta. C180)	Above confluence with Chuitna River, 3.22 km (2 mi) east of conveyor and 4.83 km (3 mi) south of mine area	39.81(.15.37)	0.02(0.81)	0.71(25.37)	12.65(451.63)
6. Unnamed Tributary 2004 (Sta. C110)	Above confluence with Chuitna River, 2.4 km (1.5 mi) southwest of mine area	46.08(17.79)	0.09(3.33)	0.99(35.43)	36.76(1312.70)
7. Tyonek Creek	(a) At conveyor crossing	3.89(1.5)	--	0.08(3)**	--
	(b) At mouth of Cook Inlet	44.03(17.0)	--	0.95(34)**	--
8. Old Tyonek Creek	(a) At conveyor crossing	2.38(0.92)	--	0.05(1.8)**	--
	(b) At mouth of Cook Inlet	60.87(23.5)	--	1.32(47)**	--
9. Unnamed tributary of Old Tyonek Creek	(a) At conveyor crossing	5.44(2.1)	--	0.12(4.2)	--
	(b) At mouth	8.81(3.4)	--	0.19(6.8)**	--
10. Unnamed Creek south of Congahbuna Lake	(a) At conveyor crossing	10.10(3.9)	--	0.22(7.8)**	--
	(b) At mouth of Cook Inlet	12.95(5.0)	--	0.28(10)	--

* Based on observations from July, 1982 to August, 1983.
** Data not available. Estimated at 0.056 m^3/sec (2 cfs) per square mile.

Source: ERT 1984a

4.4.2.1 Seasonal Flow Characteristics of Affected Streams

During the winter months (November through March), below-freezing temperatures prevail in major portions of the watersheds of the streams likely to be affected by the project. Therefore, streamflows in these months are very low with lowest flows occurring in March. The period April through August is generally dry. During this time, streamflows are augmented by snowmelt and may vary from low in August to moderately high during the peak of snowmelt in late May and early June. The most significant rainfall in the area occurs in September and October. During this period, most of the streams experience high flows and flooding conditions following storm events.

4.4.2.2 Origin of Water in Surface Streams

The sources of surface runoff transported by the streams likely to be affected by the project include rainfall, snowmelt, and ground water. Using the continuous streamflow data for Station C045 and C230 on the Chuitna River for the period August 1982 to August 1983, rough estimates of the contributions of each source have been made. These estimates are based on the assumption that streamflows in September-October are contributed mainly by rainfall, those in November through March by base flows*, those in April-May by snowmelt, and those in June-July-August by snowmelt and rain. The resulting values are shown in Table 4-7.

In the absence of detailed information on the hydrology of Tyonek Creek, Old Tyonek Creek, Threemile Creek, and other streams in the area, it is assumed that contributions of rainfall, snowmelt, and ground water to the annual runoff of these streams will be of the same order of magnitude as shown in Table 4-7.

4.4.2.3 Runoff Characteristics of Affected Streams

In the Chuitna River drainage basin, surface soils have slow to very slow infiltration rates and, therefore, high runoff potential. The Soil Conservation Service Curve Number (CN) for these soils is estimated to be 61 for antecedent moisture condition* - II (AMC-II) and 78 for AMC-III. AMC-II represents the average soil moisture condition that precedes the annual flood; AMC-III represents saturated soil conditions caused by heavy rainfall or light rainfall and low temperatures during the 5 days previous to the given storm. The minimum infiltration rate for AMC-III conditions for these soils is estimated to be 0.2 cm/hr (0.08 in/hr). Estimated runoff factors for the Chuitna River basin at Station C230, downstream of the affected area, are shown in Table 4-8.

Table 4-7

SOURCES OF SURFACE WATER IN CHUITNA RIVER BASIN

Station	Source	Approximate percentage of annual runoff*
1. C045, Chuitna River southwest of mine area (Drainage area 183.81 km^2 [70.97 mi^2])	Rainfall	26 to 40
	Baseflow	5 to 26
	Snowmelt	22
	Snowmelt & rain	24 to 34
2. C230, Chuitna River downstream of affected area (Drainage area 342.48 km^2 [132.23 mi^2])	Rainfall	25 to 42
	Baseflow	5 to 26
	Snowmelt	20 to 34
	Snowmelt & rain	16 to 34

*Ranges are based on observed mean daily minimum flow and mean daily maximum flows.

Source: ERT 1984e

Table 4-8

ESTIMATED RUNOFF FACTORS FOR CHUITNA RIVER BASIN
(Drainage area 342 km^2 [132.23 mi^2])

Storm Designation			Estimated Runoff Factor
Return Period (years)	Duration (hours)	Depth (cm[in])	
2	24	7.59(2.99)	0.32
5	24	9.45(3.72)	0.40
10	24	12.04(4.74)	0.48
25	24	13.72(5.40)	0.52
50	24	14.38(5.66)	0.54
100	24	15.09(5.94)	0.55

Source: ERT 1984e

4.4.2.4 Flooding Characteristics

The USGS gauge on the Chuitna River was maintained from 1976 to 1986, at which time it was discontinued. Estimates of the magnitude of the October 1986 flood on the Chuitna have been made by the USGS (USGS 1987). The USGS estimated that the October 1986 maximum instantaneous discharge on the Chuitna occurred on October 10 and was greater than 10,000 cfs (283 cubic meters/second). This magnitude of discharge was also estimated by the USGS to represent a flood with a return period between 50 and 100 years. Because there are only 11 years of published streamflow records for the Chuitna, estimates of flood return periods are not highly reliable.

A frequency analysis of the 11 year data set was conducted (the results are not highly reliable). The flood frequency analysis applied to the maximum annual instantaneous discharge (maximum annual flood) indicated that the maximum flood of Sept. 1976 (4300 cfs) represents approximately the average annual flood or the flood with a 2.33 year return period, the maximum flood of 1977 (6700 cfs) represents approximately a 5 year return period, the 10 year flood was estimated to range between 7300 and 8000 cfs, and the 25 year flood ranging between 9000 and 10000 cfs. The flood frequency analysis also indicated that the flood of October 1986 (greater than 10000 cfs) would represent a return period of 50 years or more. These results compare favorably with the estimated peak discharges for the Chuitna River Station C230 (at the same location as the USGS gauge) developed using synthetic methods as shown in Table 4-9.

Because no other streamflow data exists form the study area, the synthetic data represent the best available design information. The synthetic streamflows also appear to represent conservative flood values as compared to the results from the frequency analysis of the Chuitna River data.

4.4.2.5 Channel Characteristics

Channel characteristics were observed for streams north of the Chuitna River near the existing Ladd Road. These are summarized on Table 4-10. Generally, the stream channels are 10 to 20 ft (3 to 6.1 m) wide with 2 to 3 ft (0.6 to 0.9 m) vertical banks. They are well-developed, incised and V-shaped. Dense riparian vegetation and woodland comprise overbank vegetation. In the Chuitna River basin, channels appear to be dynamic and have potential for bank collapse and migration due to extreme runoff events. For flood events, less than bankfull, very little bank alteration would likely occur since they are held together by a heavy vegetative mat in most cases. Large streambed materials and low natural sediment content of the water minimize

Table 4-9

ESTIMATED PEAK FLOWS AND RUNOFF VOLUMES FOR STORMS OF DIFFERENT RECURRENCE INTERVALS[1]

Station	Drianage Area (sq miles)	2-year 24-hour storm		5-year 24-hour storm		10-year 24-hour storm		25-year 24-hour storm		50-year 24-hour storm		100-year 24-hour storm	
		Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)	Peak Flow (cfs)	Runoff Volume (acre-ft)
1. Chuitna River southwest of mine area C045	70.97	3,838	3,792	5,693	5,792	8,452	8,864	10,284	10,951	11,032	11,812	11,812	12,715
2. Chuitna River near conveyor crossing C120	88.85	3,966	4,711	5,918	7,175	8,859	10,977	10,854	13,584	11,642	14,624	12,525	15,795
3. Chuitna River downstream of affected area C230	132.23	4,209	6,825	6,398	10,471	9,704	16,050	11,952	19,879	12,852	21,419	13,830	23,095
4. Lone Creek above confluence with Chuitna River C220	19.22	985	1,097	1,456	1,660	2,162	2,525	2,633	3,111	2,828	3,355	3,030	3,610
5. Unnamed Tributary 1, 2 miles east of conveyor and 3 miles south of mine area C180	15.37	988	888	1,438	1,340	2,113	2,040	2,556	2,511	2,737	2,706	2,925	2,909
6. Unnamed Tributary 2, 1.5 miles southwest of mine area C110	14.79	1,126	855	1,619	1,290	2,347	1,964	2,822	2,417	3,016	2,604	3,215	2,800
7. Lone Creek east of mine area C200	7.15	562	429	808	647	1,167	981	1,403	1,207	1,498	1,298	1,599	1,396
8. Tributary of Chuit Creek west of mine area C020	2.37	218	142	308	214	440	325	526	400	561	430	597	463
9.. Tributary of Chuitna River just south of mine area, 0.7 miles east of conveyor C140	6.51	511	391	786	589	1,128	893	1,354	1,099	1,444	1,182	1,539	1,271
10. Tributary of Chuitna River south of mine area, 1.4 miles west of conveyor C080	9.42	780	566	1,115	852	1,603	1,292	1,925	1,590	2,053	1,710	2,190	1,839

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[1] Reported in English units to correspond with hydrological convention.

Source: ERT 1984c

Table 4-10

STREAM CROSSING CHANNEL CHARACTERISTICS (1)
LADD ROAD/NORTH ROAD AREA

ELECTRICAL TRANSMISSION ROW

Stream Crossing	Mean Width (feet)	Bank Full Width (feet)	Mean Depth (feet)	Maximum Depth (feet)	Valley Floor Width (feet)	Roughness Characteristics	Overbank Vegetation
2003	16	32	2.0	5.0	130	Coarse Gravel/Cobble	Mixed Woodland, Shrubs, & Grasses
200301	10	22	1.0	3.5	70	Silts/Cobble	Willows, Alders, & Grasses
Lone Creek (2002)	22	41	1.5	4.0	175	Silts/Cobble/Boulder	Willows, Alders, & Grasses
15	8	12	1.0	3.0	N/A	Silt/Fine Sands	Dense Riparian, Muskeg & Grasses

LADD ROAD

Stream Crossing	Mean Width (feet)	Bank Full Width (feet)	Mean Depth (feet)	Maximum Depth (feet)	Valley Floor Width (feet)	Roughness Characteristics	Overbank Vegetation
2003	16	32	2.0	5.0	60	Coarse Gravel/Cobble	Mixed Woodland, Shrubs, & Grasses
200301	10	22	1.0	3.5	70	Silts/Cobble	Willows, Alders, & Grasses
Lone Creek (2002)	22	41	1.5	4.0	180	Silts/Cobble/Boulder	Willows, Alders, & Grasses
15	7	10	0.6	3.5	N/A	Silt/Gravel	Dense Riparian, Muskeg & Grasses
10	5	8	0.5	2.5	N/A	Sand/Gravel	Dense Riparian, Muskeg & Grasses

(1) Values are composite of mulitple surveys conducted during baseline studies and are representative of the selected stream crossings.

aggradation and degradation (Riverside Technology, Inc. 1986).

4.4.3 Water Quality

4.4.3.1 Ground-water Quality

Two wells drilled in the project area (Fig. 4-6) provide information about ground-water quality outside of the lease boundary. The well southwest of Congahbuna Lake had good quality soft water that was a mixture of calcium bicarbonate and sodium bicarbonate types (DOWL 1981). Water contained low mineralization, trace element concentrations were low, and the water easily met drinking water standards (ADEC 1982). Water in a well near the Chuitna River was calcium bicarbonate type (Scully et al. 1981). Other than iron, no physical constituents or properties were in excess of the EPA (1976) or ADEC (1982) drinking water standards.

Ground-water quality in the lease area, summarized in Table 4-11, was characterized by sampling numerous test wells. This water exhibits significant variation with depth or stratigraphic position of each hydrogeologic unit (ERT 1984a). The water quality of springs is similar to stream water quality and meets all of the primary drinking water standards. Mineralization (measured by total dissolved solids and conductivity), hardness, pH, and alkalinity tend to increase with the older and deeper units. Ground water from all units, except springs, exceeds the drinking water criteria for iron and manganese and the total dissolved solids criterion is exceeded in the Sub Red 1 Sand (ADEC 1982). Iron concentrations in all units, except springs, also exceed the level critical for the preservation of freshwater aquatic life, which is 1.0 mg/l (EPA 1976). Isolated ground-water samples also equalled or slightly exceeded aquatic life criteria for zinc and ammonia. Trace elements other than iron and manganese exhibit low concentrations, as do the EPA priority pollutants.

The water quality of the upper part of Lone Creek appears to be slightly affected by discharge of ground water originating from the deeper aquifers. Ground-water input to other streams is primarily from shallow aquifers with water quality similar to surface water and, therefore, water quality differences cannot be detected (ERT 1984c).

4.4.3.2 Surface Water Quality

Data reported by Scully et al. (1981), ERT (1984e), and Maurer and Toland (1984) indicate that the water quality of streams in the Chuitna River basin (Fig. 4-5) is consistently high throughout the year, which is typical in undeveloped areas of Alaska. The stream flow is typically highly oxygenated with 90 to 100 percent saturation of dissolved oxygen and has little or no oxygen demand. The

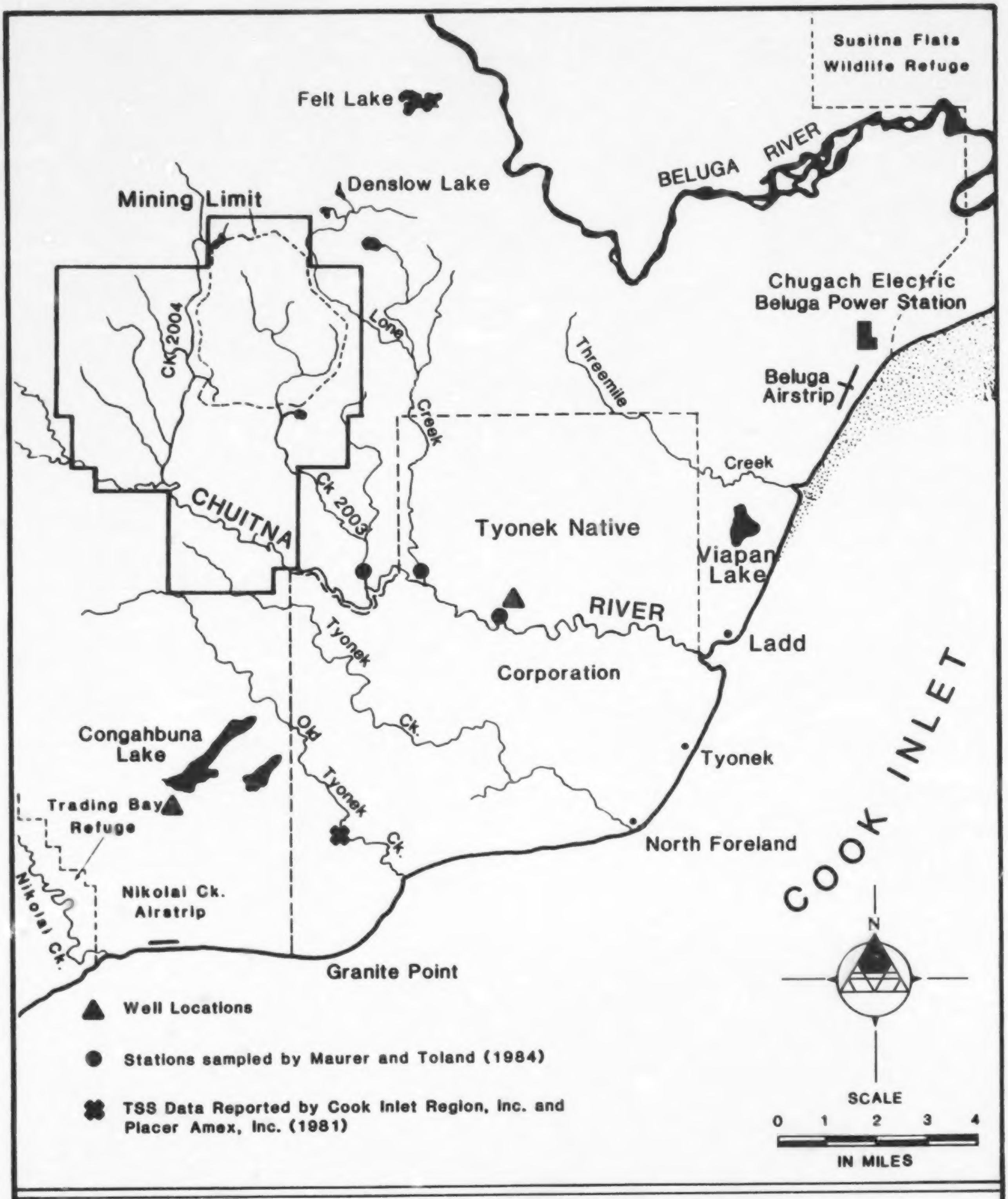
Table 4-11

GROUND-WATER QUALITY

Characteristic	Spring	Aluvium	Over-burden	Blue Coal	Red 3 Coal	Red 2 Coal	Red 1 Coal	Sub Red 1 Sand
Conductivity, micromhos/cm @ 25°C	44	180	250	280	400	590	580	910
Hardness, mg/L as $CaCO_3$	8.9	66	100	94	75	102	104	134
Dominant Cation	Ca/Na	Ca	Ca	Ca	Na	Na	Na	Na
Dominant Anion	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	HCO_3	CO_3
Sulfate, mg/L	1.9	5.0	5.8	21.2	2.5	38.9	39.7	5.9
Iron, mg/L	<0.02	3.5	5.1	2.1	2.1	12.1	39.7	3.7
Manganese, mg/L	<0.005	0.19	0.39	0.29	0.08	0.16	0.72	0.15
Zinc, mg/L	0.045	0.24	0.23	0.41	0.22	2.24	2.51	3.39
Trace Elements (other than Fe, Mn, & Zn)	Low	Low	Low	Low	Low	Low	Low	Low
Total Aromatic Hydrocarbons	Low	Low	Low	Low	Low	Low	Low	Low
Acid Extractables	Low	Low	Low	Low	Low	Low	Low	Low
Base/Neutral Extractables	Low	Low	Low	Low	Low	Low	Low	Low

Note: Values are averages for each unit.
Iron, manganese, and zinc concentrations are total recoverable levels.

Source: ERT 1984c.


Susitna Flats
Wildlife Refuge
Felt Lake
BELUGA RIVER
Denslow Lake
Mining Limit
CK 2004
Lone Creek
Threemile Creek
Chugach Electric
Beluga Power Station
Beluga
Airstrip
CHUITNA RIVER
Ck 2003
Tyonek Native
Corporation
Viapan
Lake
Ladd
Tyonek Ck.
COOK INLET
Congahbuna
Lake
Old Tyonek Ck.
Tyonek
Trading Bay
Refuge
North Foreland
Nikolai Ck.
Nikolai Ck.
Airstrip
Granite Point
N
▲ Well Locations
● Stations sampled by Maurer and Toland (1984)
✖ TSS Data Reported by Cook Inlet Region, Inc. and Placer Amex, Inc. (1981)
SCALE
0 1 2 3 4
IN MILES

WATER QUALITY SAMPLE STATIONS

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FIGURE 4-6

water displays neutral pH levels but low concentrations of alkalinity indicate the streams are poorly buffered. Mineralization is low as indicated by relatively low conductivity levels, ranging up to 120 micromhos per centimeter at 25°C (77°F). The dilute surface waters are a calcium bicarbonate type, have low concentrations of nutrients, and only a small amount of natural organic enrichment.

Breakup occurs in late April or early May. In May and June, water temperatures exhibit a moderate increase followed by a more rapid increase in late June and July. The annual maximum water temperature occurs in late July or early August and the maximum temperature recorded was 22.5°C (72.5°F) (Scully et al. 1981). Water temperatures decrease throughout September and usually reach near the freezing point by late October.

Total suspended solids concentrations have ranged up to 1570 mg/l in the Chuitna River (Scully et al. 1981). Total suspended solids concentrations and turbidity levels, however, are consistently low over a wide range in discharges on the smaller streams. In the Chuitna River, 86 percent of the suspended sediment is discharged during 10 percent of the time. Further, particle size analyses show that 30 to 70 percent of the suspended sediment consisted of sand particles and the rest was silt and clay (Scully et al. 1981).

Although iron and manganese concentrations exceed their respective drinking water criteria (EPA 1976; ADEC 1982) much of the time, concentrations of other trace elements are low. These constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, titanium, zinc, and uncomplexed cyanide. Background concentrations of boron, nickel, and zinc are low, but have been found to occasionally exceed standards for aquatic life. Organically derived ammonia nitrogen is also found to periodically exceed recognized standards. Recoverable iron has ranged up to 6.1 mg/l (Maurer and Toland 1984), with most of the measurements exceeding 1.0 mg/l--the level critical for the preservation of freshwater aquatic life (EPA 1976).

Radioactivity levels determined as gross alpha and gross beta on all samples were below the drinking water limits (EPA 1976).

Volatile organics, acid extractables, and base/neutral extractables were consistently less than their respective detection limits. This information indicates that there is no evidence of herbicides, pesticides, and other organic chemical contamination in these streams.

Limited water quality data exist for Threemile, Tyonek, and Old Tyonek Creeks. Four total suspended solids measurements in Old Tyonek Creek ranged from 2.1 to 19.0 mg/l (DOWL 1981), indicating a relatively low sediment load in this creek. U.S. Geologic Survey data (USGS 1981; USGS 1983; Still et al. 1984) indicate all three creeks display relatively low conductivity levels. Hence, mineralization is low. Water temperature ranges from 0 to at least 20°C (32° to 68°F), dissolved oxygen levels are moderately high to high, and pH values are typically neutral. Bicarbonate alkalinity concentrations are relatively low which means there is little buffering capacity in these creeks. Color levels in Tyonek and Old Tyonek Creeks are high.

4.4.4 Biology

4.4.4.1 Aquatic Ecology

There are four relatively distinct freshwater habitat types in the project area: the Chuitna River, the three tributaries to the Chuitna, Threemile Creek, and numerous ponds and small lakes (Fig. 4-5). Most of these habitats are relatively productive, supporting a diverse array of primary and secondary producers (algae and invertebrates). Where access has been available since the last ice age, resident fish have colonized many of these waters. Where access is currently possible, anadromous* fish dominate the aquatic communities.

For its lower 10 km (6 mi), the Chuitna River meanders over the relatively flat coastal plain that extends northward past the Susitna Flats. At a point about 1 km (0.6 mi) downstream of the mouth of Lone Creek, the river leaves a steep-walled valley and the sinuosity is somewhat reduced. Overall, the stream is characterized by long riffle sections interspersed with scattered deep pools. The entire mainstem through and above the project area is accessible to adult anadromous fish and is also utilized by juveniles for rearing (ERT 1984a). Substrate ranges from coarse sand to cobble and boulder with bedrock outcrops, often in the form of coal seams. Water is typically clear (non-glacial) and slightly stained with organics. Benthic productivity, as evidenced by standing crop, tended to be less than in the mine area tributaries. Mean annual flow has been estimated at 5.70 to 10.26 m^3/sec (203.68 to 366.30 cfs) with a recorded extreme range of flow of 2.41 to 112.00 m^3/sec (86 to 4,000 cfs)(ERT 1984e).

Three significant Chuitna River tributaries drain portions of the mine area. These tributaries, 2002 (Lone Creek), 2003, and 2004, contribute 15, 7, and 10 percent, respectively, of Chuitna flow below the Lone Creek confluence (ERT 1985c). In addition, Tyonek and Old Tyonek creeks would be crossed by the southern corridor. The northern corridor crosses Lone Creek, Stream 2003, and crosses Threemile Creek twice. The eastern corridor crosses Lone Creek, streams 2003, 200301, and 200205. In general, these streams can be characterized as clear-water streams with moderate to high organic staining, stable channels and flows, good benthic productivity, and good to excellent fish habitat. The benthic community is dominated by immature stages of chironomids (mosquitoes and midges), simuliids (black flies), mayflies, caddis flies, and stoneflies with species dominance shifting with time during the open water season (ERT 1984a).

The mine area contains numerous small ponds and lakes in various stages of eutrophication. Most are being encroached upon by vegetative growth that will eventually turn them into boggy muskeg. Only a few of these lakes have been shown to support fish, primarily because of limited access or limited spawning or overwintering areas. Benthos and zooplankton densities and diversities measured in these lakes appeared low (ERT 1984a); however, sampling in July likely missed periods of peak abundance.

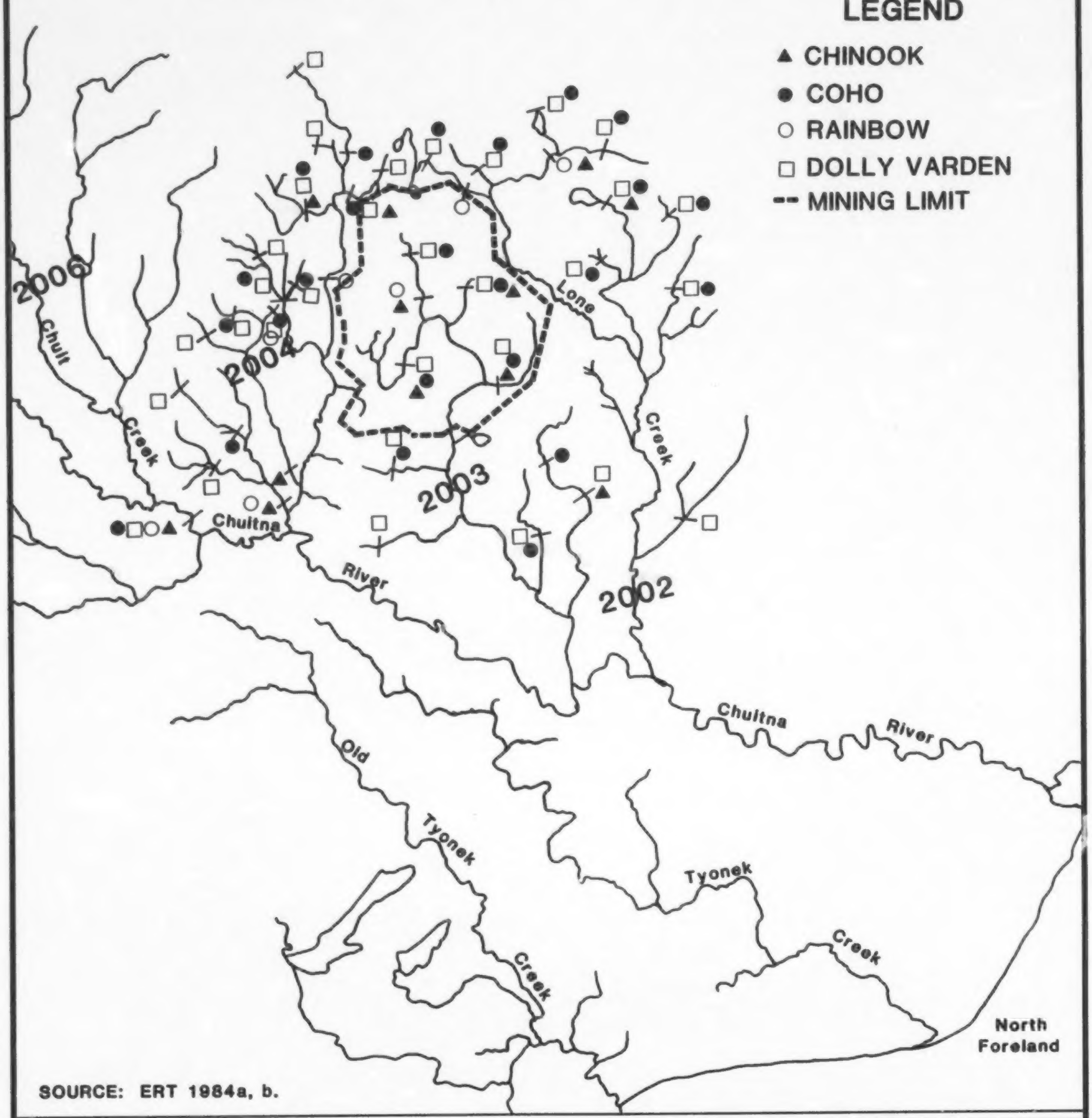
4.4.4.2 Fish

Freshwater habitats in the project area support abundant resident and anadromous fish populations that have significant subsistence, commercial, and sport value (see also Sections 4.5.3, 4.8, and 4.10.1). The distribution of fish and spawning and rearing habitat within the study area are shown in Figures 4-7 and 4-8.

At present, resident species are not significantly exploited in project area streams. Limited numbers of both resident rainbow trout (Salmo gairdneri) and anadromous Dolly Varden char (Salvelinus malma) are taken as incidental catch in the salmon sport fishery in the lower Chuitna (ADF&G 1983, 1984). Possibly the most important resident species is the rainbow trout. The mainstem of the Chuitna River, particularly upstream of Stream 2004, contains a population of modest-sized (e.g., to 1 kg [2.2 lb]) rainbows that would be capable of supporting a limited, but high-quality, sport fishery (Dames & Moore 1980). Limited access and availability of other fishing opportunities have prevented development of such a fishery to date. Juvenile rainbow trout, and perhaps smaller adults, are widely scattered but not abundant in the tributary streams draining the mine area (ERT 1984a, 1985c).

Dolly Varden are the most widespread of the salmonids found in the study area, occurring in both resident and anadromous forms. In 1983, in excess of 3,000 anadromous Dolly Varden were counted entering the system (Table 4-11; ERT 1984c). Juveniles were taken at virtually every stream location sampled that had any fish, including the uppermost reaches of tributaries to Lone Creek and streams 2003 and 2004 (ERT 1984a, Dames & Moore 1980).

Other resident fish that have been taken in the Chuitna system include Pacific lamprey (Lampetra tridentatus),


LEGEND
▲ CHINOOK
● COHO
○ RAINBOW
□ DOLLY VARDEN
-- MINING LIMIT
2006
Chuit
Creek
2004
Chuitna
River
2003
Lone
Creek
2002
Chuitna
River
Old
Tyonek
Creek
Tyonek
Creek
North
Foreland

SOURCE: ERT 1984a, b.

UPPERMOST EXTENT OF DOCUMENTED USE BY REARING JUVENILE SALMONIDS

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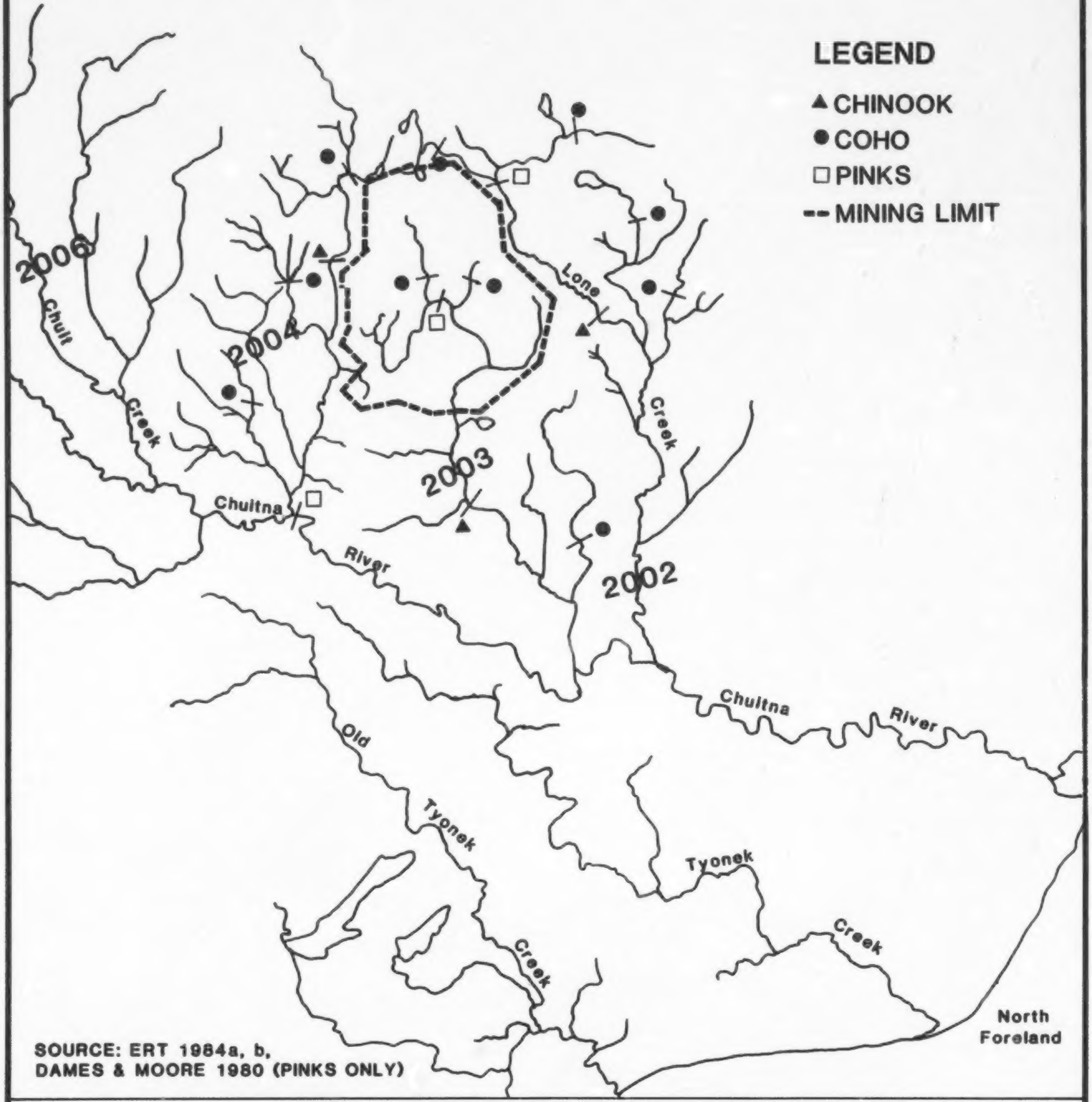
FIGURE 4-7


LEGEND
▲ CHINOOK
● COHO
□ PINKS
-- MINING LIMIT
2006
Chuit
Creek
2004
Chuitna
River
2003
Lone
Creek
2002
Chuitna
River
Old
Tyonek
Creek
Tyonek
Creek
North
Foreland

SOURCE: ERT 1984a, b,
DAMES & MOORE 1980 (PINKS ONLY)

UPPERMOST EXTENT OF DOCUMENTED USE BY SPAWNING ANADROMOUS FISH

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FIGURE 4-8

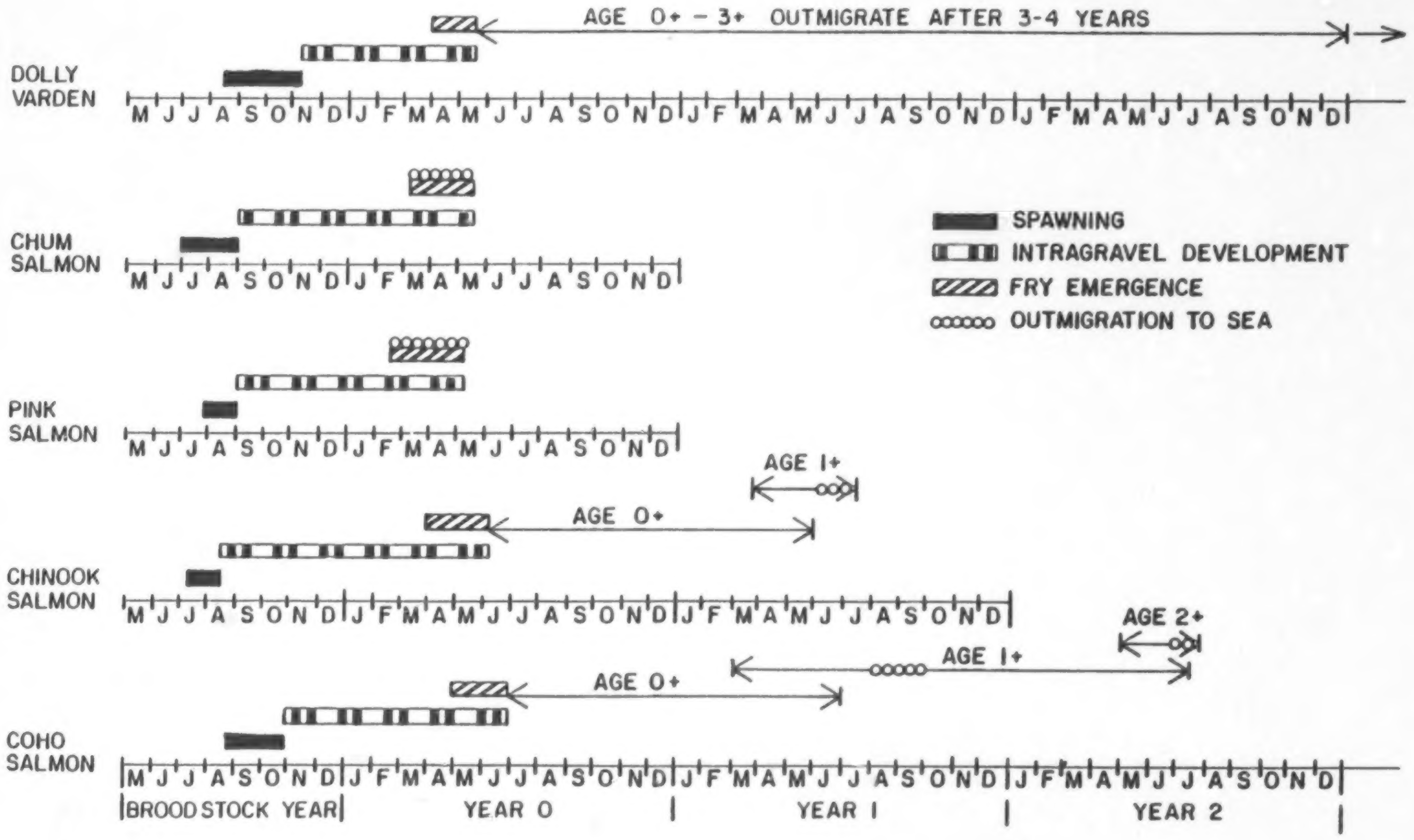
arctic lamprey (L. japonica), slimy sculpin (Cottus cognatus), coastrange sculpin (C. aleuticus), and threespine stickleback (Gasterosteus aculeatus, primarily a lake resident) (ERT 1984a).

By far the greatest fishery value of the Chuitna System is represented by the production of anadromous Pacific salmon, especially chinook (king) and coho (Oncorhynchus tshawytscha and O. kisutch). Pink salmon (O. gorbuscha) are also abundant in the system along with a few chum and red (sockeye) salmon (O. keta and O. nerka, respectively). Timing of key life history phases of important salmonids in the Chuitna System is presented in Figure 4-9. Documented spawning escapements* of chinook, coho, and pinks to the Chuitna system and to mine area tributaries are provided in Table 4-12. Chum escapements are not well documented, but are likely less than a hundred fish annually (ERT 1984a). Small numbers of red salmon are taken each year in the chinook fishery in the lower Chuitna (ADF&G 1983, 1984b).

Maturing adult chinook salmon enter the Chuitna River from mid-June through early July on their spawning migration. Estimated escapements in the three years of baseline data ranged from 3,537 to 6,000. Spawners were noted as far upstream as 6.5 km (4 mi) above the mouth of Wolverine Creek in the mainstem. Chinook spawners were documented as far upstream as 10, 5.6, and 7 km (6.2, 3.5, and 4.4 mi) above the mouths of Lone Creek and streams 2003 and 2004, respectively, in at least one of the three baseline survey years (Table 4-12, Fig. 4-8). Maximum percentage of the documented chinook escapement for the Chuitna system spawning in each creek has been 7, 14, and 8 percent, respectively. Upstream extent of chinook spawning in these three streams has declined progressively from 1982 through 1984. Upstream migration distance, and very likely escapement numbers to each stream as well, is dependent in each year on the location of impassible beaver dams.

Chinook spawn in the study area from early July through mid-August (Fig. 4-9). Preferred spawning habitat is gravel and cobbles with a tendency toward use of coarser stream bed areas. Measured spawning area water velocities ranged from 0.27 to 0.46 m/s (0.9 to 1.5 ft/s) in depths of 25 to 35 cm (0.8 to 1.1 ft) (ERT 1985c). Emergence reportedly occurs throughout April and May (Fig. 4-9). Fry usually spend one year in the stream, residing primarily in the main Chuitna and the middle and lower sections of the tributaries and feeding on a mixture of terrestrial adult and immature aquatic insects (ERT 1984a). Outmigration probably occurs during the spring but may extend from March through July (ERT 1985c). Late fall migrations out of the smaller tributaries may occur but have not been well studied. Overwintering distributions are also not fully defined.

Maturing adult coho salmon enter the Chuitna River from late July into September on their spawning migration. Coho



SOURCE: ERT, 1985

TIMING OF LIFE HISTORY PHASES FOR ANADROMOUS SALMONIDS IN THE CHUITNA RIVER DRAINAGE

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FIGURE 4-9

Table 4-12

SALMON ESCAPEMENT TO THE CHUITNA RIVER AND PROJECT AREA TRIBUTARIES

	CHINOOK				COHO				PINK				DOLLY VARDEN			
STREAM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM	YEAR	UPSTREAM LIMIT	NUMBER	% OF SYSTEM
CHUITNA SYSTEM 20	1982	to mouth of 2011 (Wolverine Fork)	3537 to 4119	100	1982	not documented	1085 to 1500	100	1980	to 2 mi. below mouth of 2004	N.E.	N.E.	1982	not documented	N.E.	-
	1983	to 4 mi. above mouth of 2011	5750 to 6000	100	1983	to 4 mi. above mouth of 2011	1600 to 1800	100	1982	to mouth of 2004	20,410+	100	1983	above mouth of Wolverine Creek	3328+	100
	1984	to mouth of 2011 (Wolverine Fork)	3900	100	1984	not documented	1900 to 2500	100	1983	to mouth of 2004	7150	100	1984	not documented	N.E.	-
									1984	to mouth of 2004	9775 mainstem only	unknown				
LONE CREEK 2002	1982	to 0.5 mi. above 200201	200+	5 - 6	1982	to above 200204 (Denslow Lake)	130+	9 - 12	1980	to mouth of 200202	several thousand					
	1983	to 0.8 mi. above mouth	338+	7	1983	to 2 mi. above 200201	312	17 - 19	1982	to 0.5 mi. above 200205	N.E.	N.E.				
	1984	to 0.8 mi. above mouth	224	7	1984	to just below 200204; 0.5 mi. into 200202	446	18 - 23	1983	to 0.8 mi. above mouth	225	3				
									1984	to 0.8 mi. above mouth	324	3				
WATERSHED 2003	1982	to near mouth of 200302	508	12 - 14	1982	not documented	70+	5 - 6	1980	to just below mouth of 200306	5000?	N.E.				
	1983	to near mouth of 200302	325	6 - 7	1983	to just above 200306	141	8 - 9	1982	not documented	N.E.	N.E.				
	1984	to 1.0 mi. above of mouth	41	1	1984	to mouth of 200306; 0.4 mi. into 200305		5 - 7	1983	to 0.8 mi. above mouth	<50	4				
									1984	to 0.8 mi. above mouth	N.E.	N.E.				
WATERSHED 2004	1982	to 1.0 mi. above 200405	280	7 - 8	1982	documented only in 200405	100+	7 - 9	1980	none seen	0	0				
	1983	to just below 200403	80+	2	1983	to mouth of 200406	144	8 - 9	1982	none seen	N.E.	N.E.				
	1984	to 0.5 mi. above mouth	9	<1	1984	to mouth of 200406	86	3 - 5	1983	none seen	0	0				
									1984	none seen	0	0				

Source: ERI 1984a, 1984b; Dames & Moore 1980 spawners have been noted as far upstream as 5.6 km (3.5 mi) above the mouth of Wolverine Creek in the mainstem and some 11 km (7 mi) up Chuit Creek (ERT 1984a). Coho spawners also were documented as far upstream as 17.6, 11.5, and 9.6 km (11, 7.2, and 6 mi) above the mouths of Lone Creek and streams 2003 and 2004, respectively, in at least one of the three baseline survey years (Fig. 4-8). Maximum percentage of the documented coho escapement for the Chuitna system spawning in each creek has been 23, 9, and 9 percent respectively. Upstream migration distance and escapement to each stream do not seem to be as dependent on the location of beaver dams as for chinook and pink salmon.

Coho spawn in the study area from late August through October (Fig. 4-9). Preferred spawning habitat is a gravel or gravel/cobble stream bed in 27 to 30 cm (10.6 to 11.8 in) of water with a velocity of 0.34 to 0.43 m/s (1.1 to 1.4 ft/s) (ERT 1985c). Emergence reportedly occurs from late April through June. Fry spend one or two years in the stream residing mainly in pools and slower reaches of accessible tributaries. They feed on a mixture of terrestrial adult insects that fall into the water and immature aquatic insects (Scott and Crossman 1973, Dames & Moore 1976). Outmigration probably occurs primarily during the spring but may extend throughout much of the year (Fig. 4-9). As with chinook salmon, late fall migrations and overwintering distributions are not well understood.

Maturing adult pink salmon enter the Chuitna River from mid-July through early August on their spawning migration. Estimated escapements in the three years of baseline ranged from 7,150 to over 20,400, with greater numbers during even-numbered years. Spawners were noted only as far upstream as the mouth of Stream 2004 in the mainstem. Pink spawners were documented as far upstream as 4.7 and 1.3 km (2.9 and 0.8 mi) above the mouths of streams 2002 and 2003, respectively, in at least one of the three baseline survey years (Table 4-12). Maximum percentage of the documented pink escapement for the Chuitna system spawning in each creek has been 3, 4, and 0 percent, respectively. However, in an earlier survey, during the exceptionally good 1980 pink year, pink spawners were far more abundant (Table 4-11) in streams 2002 and 2003 than during the baseline study years (Dames & Moore 1980). Spawning activity was noted as far upstream as 11.4 km (7.2 mi) above the mouth of Stream 2003. In Lone Creek (2002), pinks were seen as high as 14.6 km (9.1 mi) above the mouth (at the confluence of 200202) in 1980 (Dames & Moore 1980). As with chinook, upstream migration distance, and very likely escapement numbers to each stream as well, is very dependent on the location of impassible beaver dams; a trend of increasing exclusion from upper reaches of mine area tributaries has occurred since 1980.

Pink salmon spawn in the study area from late July to early September (Fig. 4-9). Preferred spawning habitat is a gravel or gravel/cobble stream bed with depths of 12 to 46 cm (0.4 to 1.5 ft) and velocities from 0.30 to 0.60 m/s (1 to 1.9 ft/s) (ERT 1985c). Emergence reportedly occurs from mid-February into May (Fig. 4-9). Fry spend only a few days or weeks in their natal stream, moving rapidly out to the marine environment and feeding little in freshwater.

Quantitative data on fish resources of other drainages that would be crossed by the alternative transportation corridors or affected by facility drainage patterns are not available. Nikolai Creek, west of the Granite Point port site has a run of perhaps several hundred chinook, as well as good runs of even year pinks, a good resident rainbow population and, very likely, some coho salmon (Hepler 1985). ERT (1984b) reported spawning pink salmon in the lower mile of both Tyonek and Old Tyonek creeks in August 1984 and coho spawners in the upper reaches of each stream in October 1984.

The eastern route to the Ladd Port site crosses two lower tributaries to the Chuitna River which support rearing juvenile salmon (ERT 1986). The outlet to Chuitbuna Lake had juvenile coho salmon as well as rainbow trout in July 1986 sampling. The next upstream tributary entering from the north (2001) had these species as well as chinook and Dolly Varden.

Threemile Creek and its tributaries, which would be crossed by the northern route, supports a run of some 3,000 sockeye salmon (O. nerka; Hepler 1985). Juvenile sockeye along with coho salmon, Dolly Varden, and rainbow trout were captured by electrofishing in the stream above and below Tukallah Lake (ERT 1987). The unnamed tributary to Threemile Creek that would be crossed by this route supported abundant coho salmon juveniles as well as Dolly Varden and rainbow trout (ERT 1987). Two small tributaries of Lone Creek (200205 and 200206) that would be crossed by the route have not been surveyed in any of the studies to date. Their small size indicates that fish use is probably minimal.

4.4.4.3 Stream Habitat Evaluation

Physical and biological characteristics of the Chuitna River and its mine area tributaries have been described above in Sections 4.2, 4.3, 4.4.4.1, and 4.4.4.2. In addition to this information, a considerable body of data on specific characteristics of individual stream reaches that may be directly or indirectly impacted by the project was gathered in the baseline studies. These data (ERT 1984a, 1985c) are essential to the impact analyses described in Section 5.0 and provide necessary documentation for designing and measuring the success of stream reconstruction and rehabilitation. Parameters that are used in the impact analysis are summarized by stream reach in Table 4-13.

Table 4-13

HABITAT AND BIOLOGICAL CHARACTERISTICS OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (a)

DRAINAGE	20 CHUITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEAM	MAINSTEM	200403
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m
REACH LENGTH (meters)	17910	3670	11340	6390	4610	8860	4020	2820	1450	2100	4630	4830	3020	360
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	4	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (i)
REACH AREA (m2)	404766	8808	41958	42813	8298	35440	18492	3384	1740	5040	11112	15939	11778	360
POOL/RIFFLE (area ratio)	0.4-0.85	0.4-1.7	0.8-3.4	1.2-4.3	0.73-12.0	1.69-7.13	0.34-0.50	31.1	0.83-290	2.08-617	0.27-4.53	1.36-4.32	2.39	-
SLOPE (%)	0.5-3.0	1.0-3.0	1.0-1.5	1.0-1.5	0.5-3.0	0.5-2.5	1.5-3.5	3	1	1	2.0-5.0	0.5	2.5	-
SINUOSITY	HIGH	LOW	HIGH	MODERATE	LOW	HIGH	LOW	LOW	LOW	MODERATE	MODERATE-HIGH	HIGH	LOW	-
RIFFLE VEL. (major category, m/s, and percent)(b)	0.31-0.76 44	0.31-0.76 90	0.31-0.76 59	0.31-0.76 75	0.16-0.30 68	0.16-0.30 65	0.77-1.1 56	0.16-0.30 71	0.16-0.30 63	0.31-0.76 67	0.16-0.30 55	0.31-0.76 61	0.31-0.76 75	- -
BEAVER DAMS	NONE	FEW	MANY	FEW	NONE	MANY	FEW	FEW	NONE	MANY	FEW	FEW	MANY	-
DISCHARGE (annual range m3/s)	2.4-113+	0.01-2.9	0.08-17.2	0.23-19.4	<0.003-0.17	0.06-4.5	0.11-9.3	0.01-0.07	0.003-0.28	0.01-0.04	<0.006-0.25	0.08-13.1	0.11-24	-
MAXIMUM MEASRED SPAWNING DENSITY (no./km)														
- CHINOOK	85	-	(j)	200	-	85(l)	85	-	-	-	45 (l)	45	-	-
- COHO	-	20	20-35	160	16-18	3-18	8	-	5	-	(j)	(j)	(j)	-
- PINK	1140	-	300(k)	190	150-250(k)	800-1000(k)	800-1000(k)	-	-	-	-	-	-	-
MAXIMUM MEASURED REARING DENSITY (no./m2)														
- CHINOOK	0.64 (d)	0.11	0.43	0.32	0	0	2.05	0	0	0.0 (e)	<0.04 (f)	<0.04 (f)	0.23 (f)	- (g)
- COHO	0.55 (d)	0.75	3.03	0.9	1.08	1.64	0.75	1.28	2.56	1.92 (e)	0.13 (h)	2.98 (h)	0.74 (h)	1.92 (e)
- RAINBOW/ DOLLY VARDEN	0.47 (d)	0.64	0.1	0.2	0.86	0.11	0.76	0.27	0.4	0.34 (e)	1.44 (h)	0.39 (h)	0.77(h)	0.34 (e)
ASSIGNED PROJECT AREA HABITAT VALUE														
- CHINOOK	VERY HIGH	MEDIUM	HIGH	VERY HIGH	LOW	HIGH	VERY HIGH	MEDIUM	MEDIUM	LOW	MEDIUM	HIGH	VERY HIGH	MEDIUM
- COHO	HIGH	HIGH	VERY HIGH	HIGH	HIGH	VERY HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	VERY HIGH	HIGH	HIGH
- PINK	HIGH	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	LOW	LOW	LOW	LOW	LOW	LOW	LOW
- RAINBOW/ DOLLY VARDEN	HIGH	HIGH	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM

(a) Source: ERT (1984a, 1984b, 1985c) except as noted.
(b) Percent of total riffle area with velocities in major category.
(c) Actual density shown is highest documented in any baseline study year.
(d) Scaled from maximum density in lower 2003 and 2003 (averaged), based on ratios of 1982 minnow trap catch per unit of effort (CPUE); applicable to shorelines only.
(e) Based on average of 200304 and 200305 values.
(f) Scaled from lower 2003 density using ratios of 1982 minnow trap mean CPUE'S from applicable reaches.
(g) No basis for extrapolaton of density values.
(h) Scaled from highest 1983 or 1984 densities on 2002 and 2003 using 1982 minnow trap mean PCUE'S from comparable reaches.
(i) Estimated value.
(j) Species is present; no density estimate obtained.
(k) Source: Dames & Moore 1980.
(l) Lower portion only.

Other physical and biological habitat data are available in the baseline studies reports (ERT 1984a,b) and the State Permit Application (ERT 1985c).

Maximum measured rearing densities and maximum spawner densities for each key species have been included (Table 4-13) for the various stream reaches that may be influenced by the project. Finally, each reach has been assigned a rating of habitat (resource) value based on a localized application of USFWS mitigation policy (FR Vol. 46, No. 15, 23 January, 1981). These assignments are based on perceived potential value of the various reaches (cf. entire drainage in standard USFWS applications), the physical and biological data available, and the assumption that access is unhindered to reaches currently blocked by beaver dams. This assumption is based on the trends observed between 1980 (Dames & Moore 1980) and 1984 (ERT 1985c) which indicate a progressive decline in numbers of chinook and pink spawners reaching upper stream areas. For example, the middle reach of the mainstem of Stream 2003 was rated as having high habitat value for chinook salmon despite the fact that none were taken in the 1983 or 1984 quantitative sampling in the reach. However, habitat present should be excellent for chinook juveniles if upstream access were not blocked by beaver dams and very likely would be used by adults for spawning as well.

Overall, the lower reaches of all three streams were rated as very high in habitat value for chinook while the middle reaches were rated very high for coho. Middle reaches were rated high for chinook based on their rearing potential but upper reaches and small tributaries tended to be rated low because low flow likely would limit access even in the absence of beaver dams. Most reaches in Lone Creek and 2003 were rated high for pinks based on the high densities of spawners seen in 1980 (Dames & Moore 1980), while 2004, where none have been seen, was rated low. All reaches were rated at least high for coho since only the uppermost reaches of the smaller tributaries lacked significant rearing by this species. Upper and lower reaches of the three streams were generally rated high for resident rainbow and Dolly Varden while middle reaches were of lesser value based on measured usage densities. The Chuitna River below 2003 was rated as very high in habitat value for chinook and high for all other species because of its combined function as a migratory pathway, spawning area, rearing area, and excellent sport fishing water.

4.5 MARINE ENVIRONMENT

4.5.1 Physical and Chemical Oceanography

Cook Inlet is a large tidal estuary with its axis trending NNE-SSW. It is divided into north and south sectors by the East and West Forelands. The Beluga region is in the north sector of Cook Inlet which has implications relative to circulation, water quality, and ice conditions.

4.5.1.1 Currents/Circulation

Tidal influences dominate currents and circulation patterns in Cook Inlet. Models of Cook Inlet tidal processes have been constructed (Carlson and Behlke 1972; Mungall and Matthews 1970) but do not offer sufficient resolution at the three possible port sites for impact assessment. Cook Inlet tides are mixed diurnal, exhibiting two unequal high and low tides in a period of about 25 hours; amplitudes range from 3 m (10 feet) at the mouth to 9 m (30 feet) at the head.

Tides were measured at the Granite Point port site for a few days during the feasibility investigations (Bechtel 1983; Nortec 1982) and these results indicate a tidal range on the order of 4 m (13 to 14 feet). Comparison of these data with predicted tides from other parts of Cook Inlet suggests some differences at the Diamond Alaska site relative to expected (adjusted predictions) tidal datum, levels and times. This affects site bathymetric survey data.

Currents, being tidally driven, reverse direction approximately every 6 hours. With the great tidal range, the velocities and turbulence of currents in Cook Inlet can be dramatic. The National Ocean Survey (NOS) conducted current monitoring in Cook Inlet during the mid-1970s. Their stations 55, 57, and 58 are in the Granite Point/North Foreland vicinity. Data from the NOS tidal current tables indicate higher flows approaching 5 knots. Because of the irregular seafloor and coastline, the ebb and flood current directions also vary from being exactly opposite in direction reversal; this is important in selecting dock location and orientation.

The highest currents measured at Granite Point during the brief feasibility investigation were on ebb, which peaked at 2.8 knots; flood tide reached 2.6 knots during this same short period. A statistical analysis (Nortec 1982) concluded that extreme tidal range at the site would be 5.8 m (17.8 feet) and extreme tidal current would be 6.2 knots. Net circulation direction across this site is probably to the southwest.

4.5.1.2 Bathymetry

Detailed bathymetric data are not available for the area between Trading Bay and the Beluga River except in the immediate vicinity of the proposed Granite Point and Ladd port sites (Nortec 1982). Navigation charts show that, in general, the sea bottom is gently sloping with a shallow shelf less than 18 m (60 ft) deep extending into Cook Inlet for a distance of 2100 m (7000 ft) to 3600 m (12,000 ft). The shelf narrows opposite the North Forelands where 18 m (60 ft) depths are found about 900 m (300 ft) from shore. The Granite Point bathymetric study indicated that many uncharted irregularities exist in the bottom topography. Shoals with water less than 18 m (60 ft) deep are present south of Granite Point and southeast of the mouth of Threemile Creek.

4.5.1.3 Wind and Wave Climate

Cook Inlet lies in a northwest-southeast storm track that is bounded on the northeast by the Canadian continental air mass and on the south and west by a maritime air mass. The location is susceptible to sudden intense storms. Prevailing winter winds are from the northeast and can reach intensities up to 66 knots. Because Cook Inlet is paralleled by mountain ranges, winds perpendicular to the channel seldom exceed 35 knots (Bechtel 1983).

There is little published data on waves in Cook Inlet. Carsola (1975) investigated waves in lower Cook Inlet and reported significant wave heights less than 0.6 m (2 feet) about 80 percent of the time. Maximum observed significant wave heights were reported at 2.4 m (8 feet) in that study. Most common wave periods are 3 to 4 seconds. The frequency of occurrence for deepwater waves greater than 2.6 m (8 ft) is about 12 percent, 5 percent for waves of 3.8 m (11.5 ft). Fishermen have reported observing waves in excess of 6.6 m (20 ft) during storms.

Tsunami waves are a possibility in Cook Inlet. Such waves were observed at Seldovia, and possibly at Homer, during the 1964 Alaska earthquake (Wilson and Torum 1968). The active volcanoes near Cook Inlet might also generate a tsunami wave. Mt. Augustine, an island in Cook Inlet south of the project area, erupted in 1976 and 1986.

4.5.1.4 Marine Water Quality

Cook Inlet water quality is incompletely understood and no studies have been done at this site. However, regional Cook Inlet studies and the dynamic mixing that is characteristic of Cook Inlet permit some generalizations for the site.

The water column is expected to be well-oxygenated. Suspended solids are very high in Cook Inlet, owing to the turbulent transport and the contribution of silt from glacier-fed runoff, which is especially high during spring/summer seasons (especially July, August, September). Rivers near the project area are important in this respect and include the Susitna, Beluga, and McArthur.

In upper Cook Inlet, the clay and silt particles are kept in suspension by the tidal currents. The circulation patterns in Cook Inlet result in much of this fine sediment being transported down the west side of the inlet, across the site (Gatto 1976). Surface suspended sediment near the site will be generally greater than 100 mg/l (Sharma et al. 1973).

Cook Inlet is a tidal estuary and its salinity may vary widely in areal distribution and by season. A mean salinity value at the site would be about 15 parts-per-thousand (Nortec 1982). During May through September, river discharges decrease the salinity of the upper inlet. Wintertime salinities rise due to greater dominance of the ocean water inputs from the south. The water on the west side of Cook Inlet tends to be fresher than on the east (Sharma et al. 1974; Burbank 1974).

Variations in surface salinities and temperatures are also a function of tide stage (Gatto 1976). The gradients will be stronger on the flood tide and less on the ebb, due to greater mixing.

The waters of western Cook Inlet are essentially unpolluted (except for natural sediment). Some local sources of pollution exist in the Anchorage and Kenai areas and in association with offshore drilling platforms. However, the flushing rate is so high that pollutants are quickly diluted.

4.5.1.5 Ice Conditions

Ice conditions are more extreme in the northern half of Cook Inlet than the southern. The ice derives from four sources: sea ice, beach ice, stamukhas*, and fresh water (river/esturary) ice. Ice floes commonly reach up to one mile across and 3-4 feet thick in Cook Inlet. Thicker ice also occurs from stamukhas and so tends to be softer. The greatest ice development is in December, January, and February. Ice floes tend to concentrate along the western shoreline during ebb tides, passing through the site vicinity.

Ice movement is primarily influenced by Cook Inlet circulation patterns, although this can be enhanced or retarded by winds. Cross-inlet ice movement due to wind forces is considered uncommon.

Local ice conditions may affect shipping and port design. There is some indication from satellite imagery that the Granite Point port site is somewhat protected from the dominant out-flowing ice due to the presence of Granite Point.

4.5.1.6 Other Marine Conditions

Corridors containing buried oil and gas pipelines extend eastward from Granite Point to offshore oil production platforms and across the inlet to Nikiski. Additional pipelines extend shoreward from oil platforms in Trading Bay. No anchoring is permitted near these corridors.

Cook Inlet is used year-round for shipping, with regular winter traffic to the Port of Anchorage. Offshore oil platforms are common in the site's operating vicinity.

Fishing vessels operate throughout Cook Inlet during the open-water seasons.

4.5.2 Biology

4.5.2.1 Lower Trophic Levels

The estuarine habitat of upper Cook Inlet is characterized by high turbidity and suspended sediment levels, extreme tides and currents, highly variable salinity, and seasonal ice formation (Section 4.5.1). This combination has discouraged biological research and has lead to the widely held conviction that, except for seasonal passage of anadromous fish such as Pacific salmon and eulachon (*Thaleichthys pacificus*), and the belukha whales (*Delphinapteras leucas*) which feed upon them, the upper Inlet is a very unproductive environment (Bakus et al. 1979). Bakus et al. (1979) looked at some portions of the biological community in the vicinity of the Anchorage airport and concluded that subtidal infauna was essentially nonexistent and that intertidal life was very poor. The diversity and abundance of plankton also was less than that observed at other locations. Macroscopic algae on the beaches in the Granite Point/Trading Bay area are reportedly limited to mats of the green alga *Vaucheria* sp., while three additional species have been reported elsewhere in the upper Inlet. In contrast, in an intensive study of Knik Arm, Dames & Moore (1983) found evidence of an active ecosystem despite these conditions and despite the apparent low primary productivity. They found that massive quantities of organic detritus are carried to the Inlet by its many tributary rivers and that an abundance of a limited number of species of large epibenthic invertebrates that are likely detritivores* (mysids, crangonid shrimp, amphipods) are found in the Inlet. Limited sampling in the vicinity of Granite Point indicate that a similar invertebrate assemblage is present at the locations of the two port site alternatives (ERT 1984a). Infauna* at the port site is very likely limited to a small bivalve (*Macoma balthica*) and unidentified polychaetes (DOWL 1981).

4.5.2.2 Fish

In addition to serving as a transport pathway bringing large quantities of organic detritus to the highly productive waters of lower Cook Inlet, the upper Inlet is also a migratory pathway for anadromous fish including all five eastern-Pacific species of salmon as well as eulachon, smelts (Osmeridae) and Bering cisco (Coregonus laurettae). A number of species of marine fish have been taken in upper Cook Inlet (Table 4-14) although their significance does not compare with that in the lower Inlet (Blackburn 1978). Limited late-summer be beach seine sampling in the North Foreland area captured 10 species of fish, including pink, chum, and coho salmon as well as Dolly Varden (age unspecified, ERT 1984a). A more intensive spring sampling regime in Knik Arm (Dames & Moore 1983) collected 18 species including five not previously reported from the upper Inlet which must be assumed to also occur seasonally in the study area (Table 4-14). More importantly, the Knik Arm study proved that fish do more than just migrate through the upper Inlet; many, including juvenile salmon, feed on the abundant epifauna in the area, while others, such as smelt and Pacific herring (Clupea harengus) may spawn on the beaches of the upper Inlet.

Use of the study area beaches and nearshore waters for these functions is unknown; however, given the considerable human activity in the area, significant beach spawning would not likely have gone unnoticed. Beaches in the study area do not appear unique in any way and the Knik Arm study did not detect any particular preferences of fish for specific beach types. Certainly, there is considerable feeding by juvenile anadromous fish in the area, particularly on the broad flats and tidal channels of Trading Bay and around the mouth of the Chuitna River. Adult salmon returning along the shoreline to their natal streams probably do not feed extensively in the upper Inlet. For them, the study area shoreline likely is an extremely important migratory pathway providing access to the numerous rivers to the north. Commercial fisheries in the area are discussed in Section 4.5.3.

4.5.2.3 Birds and Mammals

Most beaches, mud flats, and nearshore waters of upper Cook Inlet are not heavily utilized by waterfowl and marine birds (Dames & Moore 1983). Small numbers of gulls (Laridae) and sea ducks rest on the water surface but foraging opportunities are limited by the high turbidity. Scarcity of infauna likewise may discourage use by shorebirds, except in small bays and at the mouth of creeks and rivers. An exception to this generally low use by birds occurs in the large saltmarsh and mud flat areas of Trading Bay to the south and the Susitna Flats to the north, as well as the much smaller flats around the mouth of the Chuitna

Table 4-14

FISH SPECIES KNOWN TO OCCUR IN UPPER COOK INLET

Scientific Name	Common Name	Spawning Period[1]	Time Spent in Marine Enviroment
Fish			
Salmonidae	Trout, salmon, white fish		
Oncorhynchus gorbuscha	Pink (humpback) salmon	mid-July - early Sept.	1+ year
O. keta	Chum (dog) salmon	early Aug. - early Oct.	2 - 4 years
O. kisutch	Coho (silver) salmon	early Aug. - Feb.	1 -3 year
O. nerka	Sockeye (red) salmon	early Aug. - Nov.	1 - 4 years
O. tshawytscha	Chinook (king) salmon	mid- June - mid-Aug.	1 - 6 years
Salmo gairdneri	Steelhead (rainbow) trout[2]	fall - spring	2 mo. - 4 years
Salvelinus malma	Dolly Varden	fall	several weeks to 6-7 months
Coregonus laurettae	Bering cisco	fall(?)	2 - 3 months per year
Osmeridae	Smelts		
Hypomesus pretiosus	Surf smelt	March to May	entire life cycle
Sperinchus thaleichthys	Longfin smelt	Oct. to Dec.	1 - 2 years
Thaleichthys pacificus	Eulachon	mid- to late May	entire life cycle except about 2 weeks
Clupeidae			
Clupea harengus pallasi	Pacific herring	spring	entire life cycle
Gadidae	Codfishes		
Gadus macrocephalus	Pacific cod	usually Jan. & Feb.	entire life cycle
Theragra chalcogramma	Walleye pollock	winter	entire life cycle
Elginus gracilis	Saffron cod		entire life cycle
Gasterosteidae	Sticklebacks		
Gasterosteus aculeatus	Threespine stickleback	June to July	variable, but anadromous forms spend up to 1 year in fresh water before moving to sea
Pungitius pungitius	Ninespine stickleback	May to July	variable, always spawn in fresh water
Liparidae	Snailfish		
Liparis rutteri	Ringtail snailfish		entire life cycle
Cottidae	Sculpins		
Leptocottus armatus	Pacific staghorn sculpin	Oct. to March	entire life cycle
Pleuronectidae	Flounders		
Platichthys stellatus	Starry flounder	March to April	entire life cycle
Hippoglossoides elessodon	Flathead sole	March to late April	entire life cycle
Hippoglossus stenolepis	Pacific halibut	winter	entire life cycle
Limanda aspera	Yellowfin sole		entire life cycle

Sources: ERT 1984a, Dames & Moore 1983, Scott and Crossman 1973.

[1] No anadromous rainbows are known from rivers north of east and west forelands; however, Dames & Moore (1983) captured a single sexually mature rainbow (195 mm [7.7 in]) in uper Cook Inlet in May 1983.

River and between Granite Point and Nikolai Creek. These areas are very important spring and fall staging areas for a number of waterfowl and shorebird species and are important sport hunting areas as well (see Section 4.10.2). In addition, a small (estimated 30 nesting pairs) colony of glaucous-winged gulls is located about 0.8 km (0.5 mi) north of the proposed Ladd port site (ERT 1986).

Only two of the 21 species of marine mammals reported from lower Cook Inlet are common in the upper Inlet; these are belukha (beluga) whale (Delphinapterus leucas) and harbor seal (Phoca vitulina) (Calkins 1981). In the study area, both species are common primarily in the spring and summer when they feed on anadromous fish near the mouths of rivers. The area from Trading Bay to the Susitna River appears to be especially important for belukhas with numerous sightings near the mouth of the Beluga River during July of 1982 and 1983 by baseline study team members (ERT 1984a). The area between the Beluga and Susitna rivers may also be a significant calving and/or nursery area for belukhas (Calkins 1981).

Information on the life history of harbor seals in upper Cook Inlet is incomplete; however, they are common at times in certain areas (ERT 1984a). Harbor seals are present from May to September. During the winter months, they most likely move to Lower Cook Inlet. Like the belukha, they appear to feed on anadromous fish, following them to, and into, the mouths of the Inlet's tributary rivers.

4.5.2.4 Threatened or Endangered Species

None of the marine biota known to frequent the study area are considered endangered or threatened.

4.5.3 Commercial Fisheries

The only significant commercial fishery in upper Cook Inlet is that for the five species of Pacific salmon. Above the East and West Forelands, all commercial fishing is by set net (fixed gill net). Tyonek residents held 26 set net permits in 1983. The area from Chuit flats to Threemile Creek is fished intensively; set net sites are nearly continuous. Commercial fishing is somewhat less intensive from Chuit Flats to Granite Point. Permits in this area are held almost exclusively by Tyonek residents. From Granite Point west to within 1.6 km (1 mi) of Nikolai Creek, there are some 14 permits held and fished by local residents or lease holders (individuals leasing fishing camp sites).

The combined total catch of all species of salmon in ADF&G statistical areas 247-10 (West Foreland to Granite Point) and 247-20 (Granite Point to Threemile Creek) have averaged 3.5 percent of the total upper Inlet catch over the last 22 years (Table 4-15). While numbers of fish taken in these two reporting subareas have declined in the last 8 years, the percentage contribution to the total upper Inlet fishery has declined to 2.5 percent (Table 4-15), probably due to increased effort in other portions of the upper Inlet. Since 1980, these two commercial fishery subareas on either side of Granite Point have contributed the highest percentage of chinook and coho salmon (13.2 and 6.4 percent, respectively, using 1980-1987 averages) and the lowest percentage of chum and sockeye (1.3 and 1.5 percent respectively each using 1980-1987 averages). This harvest distribution coincides to a degree with the relative importance of these species in the Chuitna River, although what proportion of the catch is actually contributed by the Chuitna System has not been determined.

4.6 METEOROLOGY, AIR QUALITY, AND NOISE

4.6.1 Meteorology

The regional climate near the project site is most noticeably influenced by regional topography and bodies of water. The Chugach Mountains to the south act as a barrier to warm, moist air from the Gulf of Alaska, decreasing local precipitation to less than 20 percent of that measured on the Gulf of Alaska side of the Chugach Range. The Alaska Range to the west and north acts as a barrier to very cold winter air masses which dominate the Alaska interior. Cook Inlet tends to moderate temperatures in the project area.

A one-year meteorological monitoring program was conducted at the project site from April 1983 through March 1984 (Science Applications, Inc. 1984). Two monitoring sites were installed: one near the proposed surface coal mine and a second near the proposed Granite Point port facilities. Wind speed, wind direction, and temperature were measured at 12 meters (39.4 ft) above ground level at both sites.

Seasonal wind roses for the two sites, given in Figures 4-10 and 4-11, show a predominant southerly flow during the summer months and a predominant northerly flow during the rest of the year. At Granite Point, north and northeast wind directions occur most frequently during the fall, winter, and spring seasons while the most frequent wind directions during the summer are south-southwest and south with a secondary maximum at north-northeast. At the coal mine site, the predominant wind directions measured were north-northwest and north during the fall and winter, north-northwest through north-northeast with a small secondary maximum at south-southeast during the spring, and south through southwest with a large secondary maximum about north during the summer. Wind speeds at both sites were relatively light, averaging 3.1 m/sec (6.9 mph) and 2.4 m/sec (5.4mph) for the monitored year at the port and coal mine sites, respectively.

Table 4-15

UPPER COOK INLET SALMON CATCH SUMMARY 1954-1987[1]

LOCATION	CHINOOK				SOCKEYE				COHO			
	1954-87		1980-84		1954-87		1980-84		1954-87		1980-84	
	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
UPPER COOK INLET (No. of Anchor Pt.)	20574	100.0	15262	100.0	1753503	100.0	2658000	100.0	293441	100.0	501881	100.0
	1966-87		1980-87		1966-87		1980-87		1966-87		1980-87	
	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
NORTHERN DISTRICT (No. of Forelands)	2733	13.3	4538	29.7	112213	6.4	167246	6.3	64918	22.1	92533	18.4
AREA 247-10 (W. Foreland Granite Pt.)	641	3.1	952	6.2	11877	0.7	15359	0.6	13642	4.6	15224	3.0
AREA 247-20 (Granite Pt. to Threemile Creek)	538	2.6	1067	7.0	14354	0.8	21213	0.8	13119	4.5	17137	3.4

LOCATION	PINK				CHUM				ALL SPECIES			
	1954-87		1980-84		1954-87		1980-84		1954-87		1980-84	
	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
UPPER COOK INLET (No. of Anchor Pt.)	835807	100.0	679417	100.0	665418	100.0	891441	100.0	3568746	100.0	4773000	100.0
	1966-87		1980-87		1966-87		1980-87		1966-87		1930-87	
	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%	AVE	%
NORTHERN DISTRICT (No. of Forelands)	136185	16.3	113798	16.7	35126	5.3	48179	5.4	351175	9.8	426293	8.9
AREA 247-10 (W. Foreland Granite Pt.)	31462	3.8	19960	2.9	3992	0.6	3298	0.4	61615	1.7	54793	1.1
AREA 247-20 (Granite Pt. to Threemile Creek)	28195	3.4	19079	2.8	8294	1.2	7706	0.9	64500	1.8	66202	1.4

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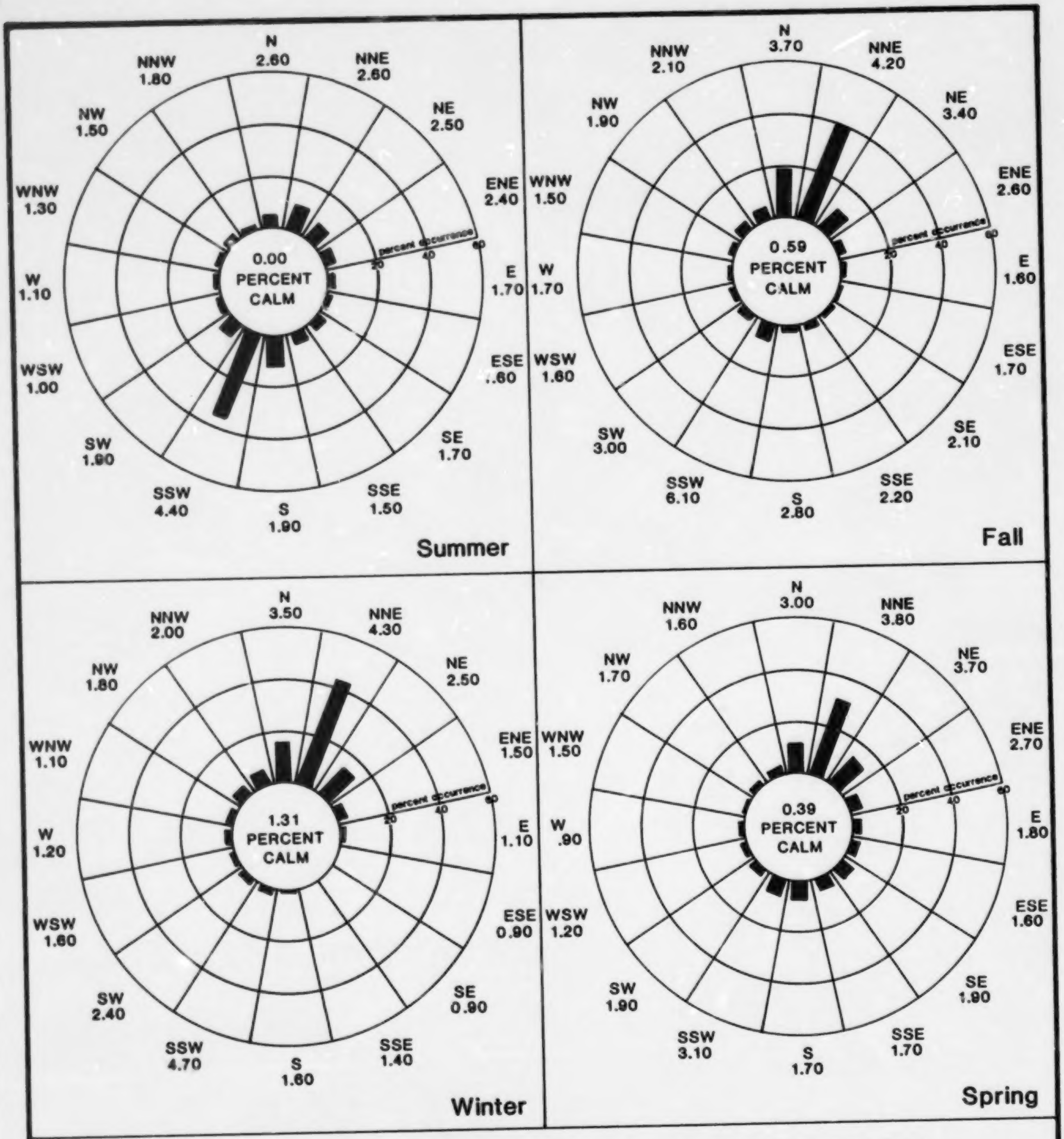
1. Data from S. Seagren, ADF&G Commercial Fish Divison, Soldotna; 1984 and 1985 data are preliminary; Upper Inlet includes all gear types; other subareas are only fished by set net. All percents are given as a percentage of the total Upper Inlet harvest.

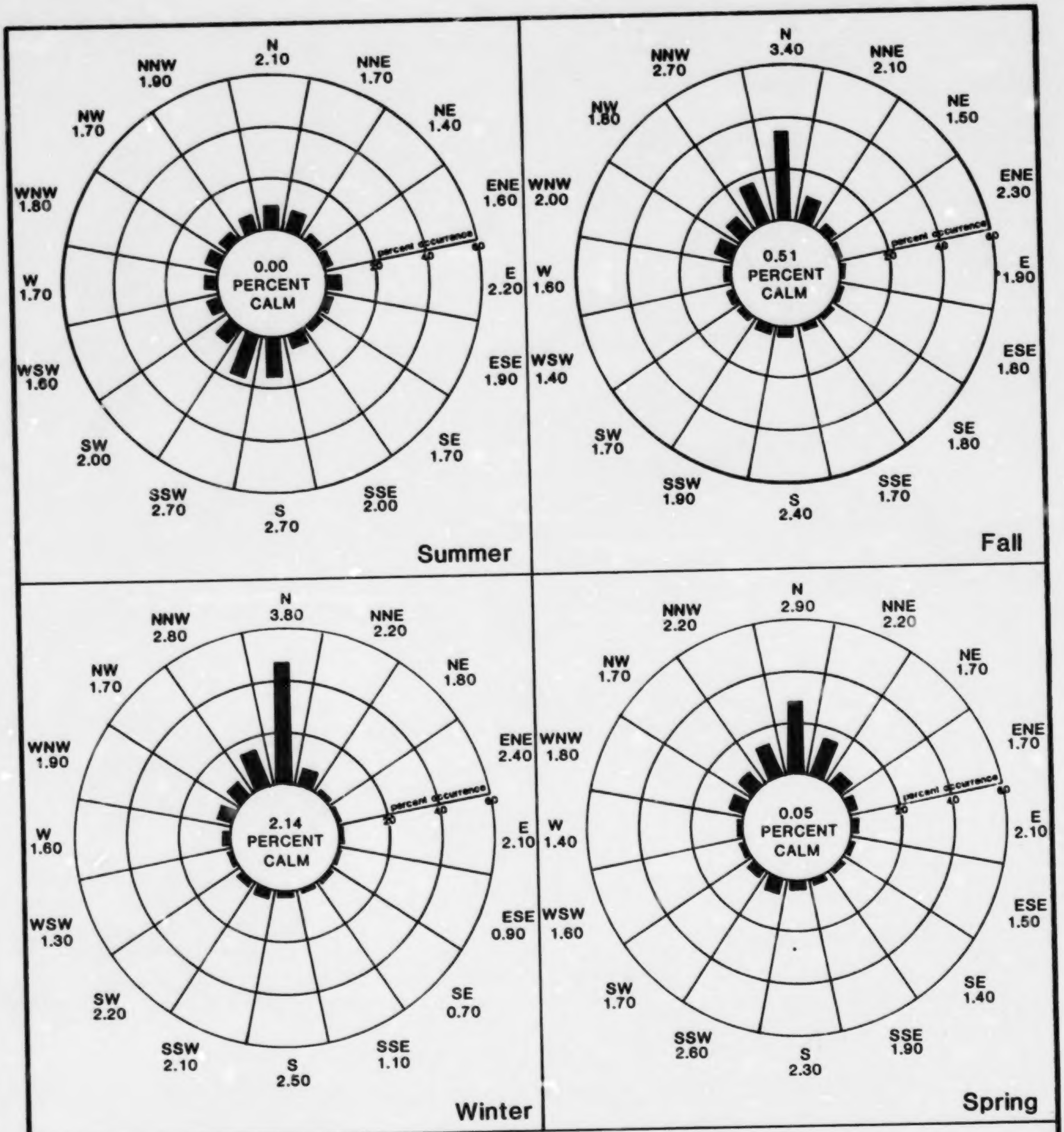


NUMBERS INDICATE SECTOR MEAN WIND SPEED (METERS/SEC.)

SOURCE: SCIENCE APPLICATIONS INC., 1984

WIND FREQUENCY DISTRIBUTION
GRANITE POINT PORT SITE

Diamond Chuitna Environmental Impact Statement	FIGURE 4-10



NUMBERS INDICATE SECTOR MEAN WIND SPEED (METERS/SEC.)

SOURCE: SCIENCE APPLICATIONS INC., 1984

WIND FREQUENCY DISTRIBUTION
MINE SITE

Diamond Chuitna Environmental Impact Statement

FIGURE 4-11

The climates of Anchorage and Kenai are similar to that of the project area due to the influence of the Chugach and Alaska mountain ranges and Cook Inlet. Seasonal wind roses for Anchorage (Figure 4-12) show a northerly flow during fall and winter and a southerly flow in spring and summer. North to northeast winds occur during the fall and winter months, while south to southeast winds dominate during the spring and summer months. Wind speeds at Anchorage are comparable to those of the project area, averaging 3.3 m/sec (7.3 mph).

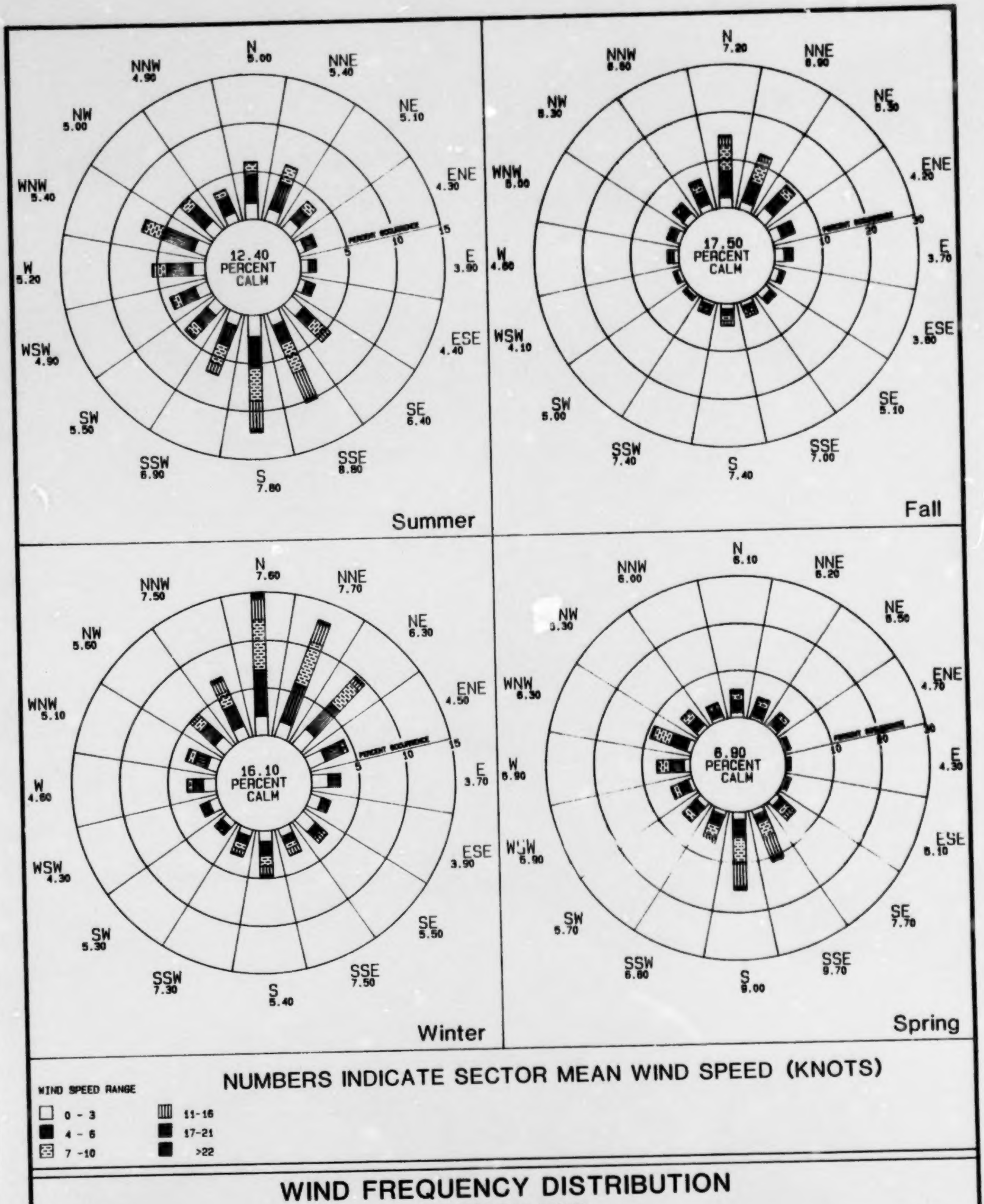
Wind roses for Kenai (Figure 4-13) also show a strong northerly flow during fall and winter and a more subtle southerly flow in spring and summer. North to north-northeast winds are dominant during the fall and winter months, while south to southwest winds are frequent in spring and summer. Wind speeds at Kenai are similar to those at the project sites and Anchorage, averaging 3.4 m/sec (7.5 mph).

Monthly temperatures measured at the project monitoring sites are given in Table 4-16. Temperatures measured at the port site were slightly warmer than the mine site, particularly during the winter, with the mine site exhibiting slightly higher maximum daily temperatures in the summer. This pattern is typical for a shoreline environment and demonstrates the moderating effect of Cook Inlet on ambient temperatures. Maximum and minimum temperatures measured at either site were 22°C (71°F) and -22°C (-7°F), respectively. Temperature and precipitation summaries from a one-year monitoring program near Kenai (June 1981 through May 1982) are also given in Table 4-16. No site-specific precipitation data were measured at either project monitoring site. Average yearly precipitation in the Chuitna Basin is approximately 122 cm (48 inches), which is considerably greater than the 39 cm (15.4 inches) measured near Kenai. This difference is due to orographic* effects reflecting the higher elevations in the Chuitna Basin area. In 1983, snow depths in the area varied from 58 cm (23 in) near Congahbuna Lake to 229 cm (90 in) on Capps Plateau.

4.6.2 Air Quality

Air quality data for the project site area were available from the following programs:

- Monitoring site operated for Tesoro Petroleum near Kenai during June 1981 through May 1982 (All major criteria pollutants were measured except lead)
- ADEC Total Suspended Particulate monitor located on the Beluga Power station during April 1978 through May 1979
- ADEC SO_2 monitoring site located near Kenai at Wik Lake for November 1982 through May 1983.



NUMBERS INDICATE SECTOR MEAN WIND SPEED (KNOTS)

WIND FREQUENCY DISTRIBUTION
ANCHORAGE

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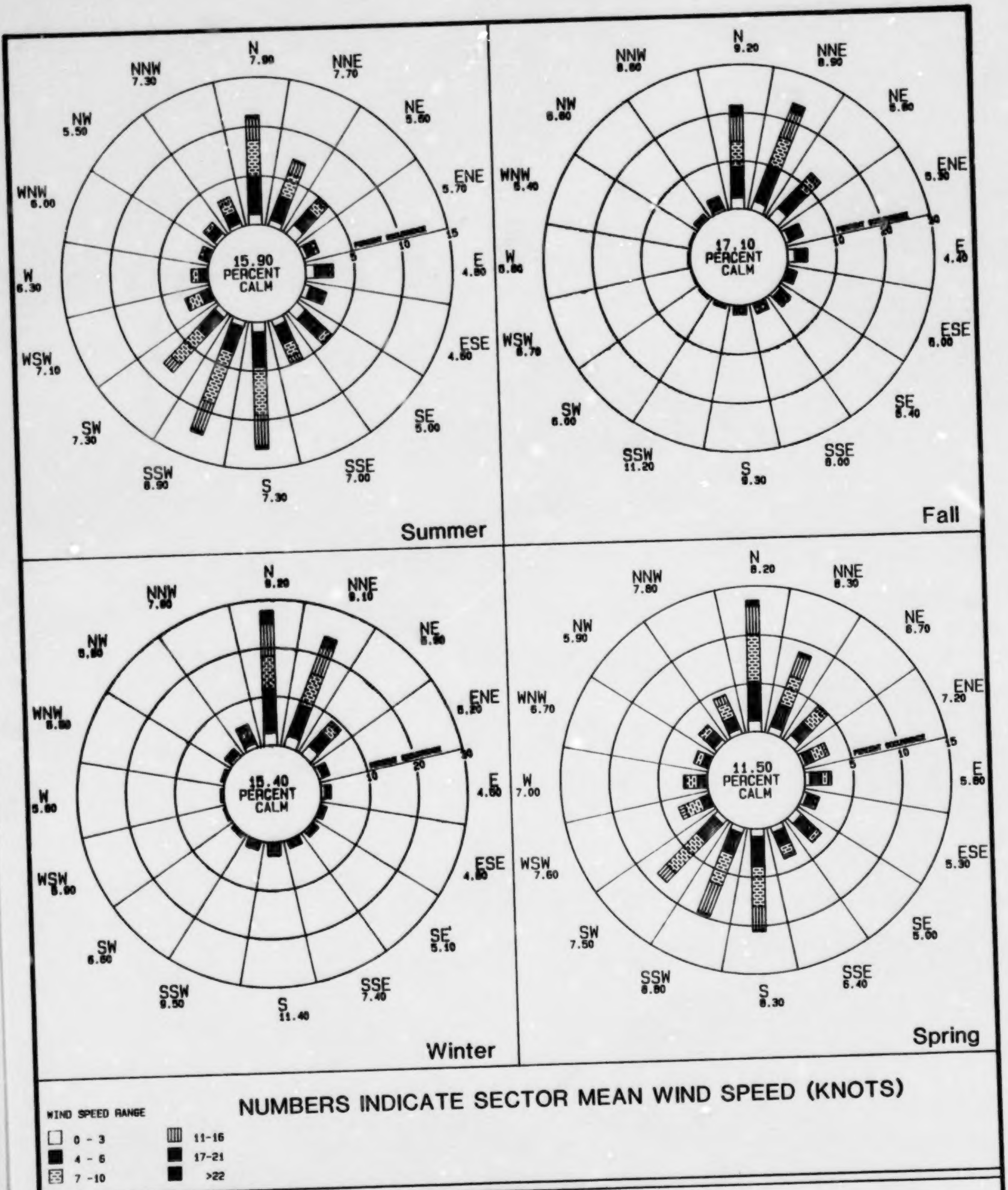
FIGURE 4-12



WIND FREQUENCY DISTRIBUTION
KENAI

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FIGURE 4-13

Table 4-16

MONTHLY TEMPERATURE (°C) AND PRECIPITATION (cm) SUMMARY FOR PROJECT REGION

Month	Monthly Average Temperature			Average Daily Max. Temperature		Average Daily Min. Temperature		Monthly[1] Precipitation
	Port	Mine	Kenai	Port	Mine	Port	Mine	Kenai
JAN	-4	-5	-12	-2	-3	-7	-8	0.
FEB	-5	-6	-8	-2	-3	-7	-8	2.
MAR	3	2	-3	5	4	1	0	2.
APR	3	2	0	5	4	1	0	0.
MAY	8	7	5	11	10	5	4	1.
JUN	12	12	10	15	15	9	8	2.
JUL	13	13	12	15	16	11	9	5.
AUG	13	12	11	15	15	10	9	4.
SEP	8	6	9	11	9	5	3	6.
OCT	3	0	3	5	3	0	-1	12.
NOV	1	0	-4	2	2	-1	-1	4.
DEC	-4	-4	-8	-1	-2	-6	-5	1.
YEAR	4	3	1	7	6	2	1	39.

[1] given as liquid water equivalent

Source: Science Applications, Inc. 1984; Radian Corp. 1982

Maximum measured concentrations from the Tesoro and Beluga monitoring sites are compared to ambient air quality standards in Table 4-17. These data indicate that measured ambient background levels of all major pollutants were significantly less than applicable standards. Sulphur dioxide (SO_2) data measured at the Wik Lake monitor during the available data period were nearly always 0 ppb (1-hour measurement) with an occasional 5 ppb reading which may have been due to instrument zero drift.

Since the project site is considerably more remote than the Tesoro monitoring site, air quality is expected to be better than that presented in Table 4-17.

4.6.3 Sound Climate

The project area in the vicinity of the proposed mine and transportation corridor is expected to experience sound levels typical of remote locations unaffected by human activities. Typical natural sound levels are approximately 45 db(A) with higher levels of natural sound of about 65 db(A) associated with storms and wildlife. Sources of natural noise include winds, rain, and wildlife vocalizations.

The project area in the vicinity of the Cook Inlet coast experiences higher background noise levels. Cook Inlet contributes higher noise levels because of breaking waves and winter ice movements. Human activities are also more frequent near the coast. Some examples of human-generated noise include vessels (such as diesel-powered boats on Cook Inlet), aircraft (a landing strip is located approximately 2 miles from the proposed Granite Point port site), and other mobile vehicles such as snowmobiles and all-terrain vehicles. Typical noise levels for vehicles and aircraft are 80 to 95 db(A) at a distance of 50 feet. Commercial and noncommercial aircraft on route from Anchorage to southwestern Alaska locations fly over the project area routinely at varying altitudes.

4.7 SOCIOECONOMIC ASPECTS

The project site is located about 75 air miles west of Anchorage in the Kenai Peninsula Borough and about ten miles west of the Native village of Tyonek. Socioeconomic impacts would likely derive from increased income and employment of residents of both Anchorage and the Kenai Peninsula Borough, particularly the City of Kenai and the Village of Tyonek. The City of Kenai is the Borough seat of government and its most populous city; Tyonek is the nearest community to the project site. The following description of the socioeconomic environment focuses on conditions in the Kenai Peninsula Borough, the Municipality of Anchorage, and the community of Tyonek.

Table 4-17

REGIONAL MEASURED AIR QUALITY DATA
(micrograms/cubic meter)

Site/Pollutant	Averaging Time				
	1-hour	3-hour	8-hour	24-hour	Annual
FEDERAL AND ALASKA AIR QUALITY STANDARDS					
NO_2	- [a]	-	-	-	100
SO_2	-	1300	-	365	80
CO	40000	-	10000	-	-
O_3	235	-	-	-	-
PM	-	-	-	150	60
TESORO PETROLEUM					
NO_2	-	-	-	-	6.3
SO_2	-	70	-	9	0.3
CO	2560	-	1660	-	-
O_3	96	-	-	-	-
PM	-	-	-	60	9
BELUGA					
PM	-	-	-	78	- [b]

[a] indicates that an air quality standard does not exist for this pollutant and averaging time; hence, no measured air quality data will be presented.

[b] No annual average PM concentration was calculated for Beluga due to the large amount of missing data.

Source: Chapple 1985; Radian Corp. 1982

4.7.1 Anchorage and Kenai Peninsula

4.7.1.1 Population

The population of Anchorage and the Kenai Peninsula Borough grew rapidly between 1970 and 1984, exceeding the substantial statewide growth of 77.8 percent. Anchorage grew from 126,385 persons in 1970 to 244,030 in 1984-an increase of 93.1 percent. The Kenai Peninsula Borough population increased by 134.6 percent from 16,586 in 1970 to 38,919 by 1982 (Alaska Department of Labor 1984). The City of Kenai grew by 42.8 percent over this period, from 4,324 to 6,176 persons. The Central Kenai Peninsula, which includes the area within primary commuting distance of the City of Kenai, had a 1984 population of 24,643. Historical population trends are summarized in Table 4-18.

The State of Alaska currently has no official population projections for either the Kenai Peninsula Borough or Anchorage (Williams 1985). Population forecasts used here assume a slowdown of growth for the Kenai Peninsula Borough from 11.1 percent annually over the 1980-84 period to 5 percent per year through 1992. Thus, by 1992 the population of the Kenai Peninsula Borough is expected to be approximately 57,500. The 1992 populations of the City of Kenai and the Central Kenai Peninsula are projected to be 9,100 and 36,400 respectively, based on a 5 percent average annual increase. Preliminary draft population projections for Anchorage indicate a high projection of 314,800 by 1990, a low projection of 273,100, and a medium or most likely population of 292,300 (Breedlove 1985).

4.7.1.2 Economy

The following discussions of the economies of the Kenai Peninsula Borough and Anchorage focus on the cash economy. Subsistence activities, which provide food and sustenance for many residents of the Kenai Peninsula Borough, are not reflected in the statistical data presented. Therefore, comparisons of data for Anchorage, in which relatively little subsistence activity occurs, to data for the Kenai Peninsula Borough, where, in some areas, substantial subsistence activities are conducted, must be made carefully. A discussion of subsistence activities of the Tyoneks is presented in Section 4.9.

The economies of the Kenai Peninsula Borough and Anchorage are distinctly different. While employment in Anchorage is relatively concentrated in trade, service, and federal government, employment in the Kenai Peninsula Borough is based primarily on resource development industries and state and local government.

Table 4-18

POPULATION TRENDS IN ALASKA, ANCHORAGE, AND THE KENAI PENINSULA BOROUGH

	Population			
Jurisdiction	1970(a)	1980(a)	1982	1984
Alaska Statewide	302,583	401,851	460,837(b)	538,000(c)
Anchorage	126,333	174,431	204,216(c)	244,030(c)
Kenai Pen. Borough	16,586	25,282	5,231(d)	6,176(d)
-Central Kenai Pen. Bor.	na	15,672(e)	19,886(f)	24,643(f)

(a) Source: U.S. Department of Commerce, Census counts for years indicated.

(b) Source: Alaska Department of Labor 1984.

(c) Source: Van Patten 1985.

(d) Source: Kenai Peninsula Borough 1984.

(e) Source: Unavailable from census in geographically-consistent form. Figure is cited from 1978 special census conducted by Kenai Peninsula Borough which resulted in total Borough population estimate very close to the 1980 census estimate, considered by local planners to be a substantial undercount (McIlhargy 1985).

(f) Source: McIlhargy 1985.

Over time, employment patterns in the Kenai Peninsula Borough indicate a proportional drop (but a small numerical increase) in mining employment (the standard industrial code of mining includes oil and gas extraction). The loss of federal government jobs since 1970 has been counteracted by increases in state and local government, employment, manufacturing (including petrochemical industry), and the service sector (trade, services, and finance, insurance, and real estate). The sectors that bring new income into the region (the "basic" or "export" sectors) are primarily federal government, mining, and manufacturing. Tourism is also an important basic sector, but existing data do not isolate tourist-serving employment and therefore the employment involved is not readily quantifiable.

The Anchorage economy has diversified since 1970 and has become more service-oriented. Dependence on federal government employment has declined and the proportion of employment in all other economic sectors has increased.

Unemployment rates in the Kenai Peninsula Borough have historically been substantially higher than those in Anchorage, as well as more subject to seasonal swings. Over recent years, the average annual unemployment rate in the Kenai Peninsula Borough has ranged from a high of 15.9 percent in 1982 to a low of 10.1 percent in 1977. The monthly unemployment rate, however, has been nearly 22 percent during winter months. Unemployment in Anchorage has remained within a narrow 7 to 8 percent range and exhibits relatively modest seasonal changes.

Unemployed workers in the Kenai Division tend to have previous experience in the oil and gas and construction industries, compared to the statewide average. Of the 2,165 unemployment claims filed with the Kenai office of the Alaska Department of Employment Security in 1982, 16.6 percent, or about 360, listed oil and gas as the last industry of employment and 24.8 percent, or about 540, listed construction. The corresponding Anchorage local office figures indicate that 22 percent of the unemployment insurance applications listed construction as last industry of employment. Oil and gas was listed by 6.4 percent. In terms of skills, structural work was the occupation listed by most applicants in either office (40.9 percent for Kenai and 28.7 percent for Anchorage) (Alaska Department of Labor 1984). It should be noted that there are probably fewer individuals represented by the above data which was taken from the number of applications, since some applicants probably applied twice or more during the course of the year. However, since only the last industry of employment and occupation are listed on unemployment insurance applications, the figures above probably understate the actual experience of applicants over their careers.

The Borough-wide employment-to-population ratio was 36 percent in 1984. Since labor force participation rates will likely continue to increase, a projected employment-to-population ratio of 40 percent is used herein. The area included within the primary Kenai commuting area is the Central Kenai Peninsula (CKP), consisting of Sterling, Soldotna, Ridgeway, Kalifonski, Kenai, Salamatof, Nikiski, and Tustumena. This area had a population of 24,643 in 1984 and is projected to grow by 5 percent annually without the project, to 30,000 by 1988 and 36,400 by 1992. If 40 percent of the population is employed, the number of employed residents of the CKP would be about 12,000 in 1988 and 14,600 by 1992. If the assumed annual Borough-wide population growth rate of 5 percent (Section 4.7.1.1) applies to the City of Kenai's employment base, about 3,000 of its residents would be employed by 1988 and about 3,700 by 1992.

Per capita personal income in the Kenai-Cook Inlet Division was $13,394 in 1982. This was somewhat below the statewide average of $16,598 and the Anchorage Division figure of $18,429 (U.S. Department of Commerce 1984a).

Cost-of-living differentials between these three areas, however, prevent accurate comparison in terms of real income.

4.7.1.3 Community Facilities and Services

As Alaska's primary urban area, Anchorage is in general well-served by all facilities and services necessary for urban life, making detailed discussion unnecessary. For a smaller community, the City of Kenai is also generally well-served by sewer, water, and road systems and public services such as fire and police protection and education.

Public Services and Facilities in Kenai

Kenai's water system services much of the city, with about 1,100 residential connections (compared to an estimated 2,446 housing units in 1984 [Kenai Peninsula Borough 1984]) serving 3,500 people and under 100 commercial connections. The City's water source is the aquifer at Beaver Creek, which is of excellent quality and requires only chlorination at the wellhead. The combined design capacity of the City's two water pump stations is about 2,000 gallons per minute, or about 2.9 million gallons per day (gpd). Daily water demand averages slightly less than 500,000 gpd, with a peak of about 1,200,000 gpd (Lashot 1985).

Kenai's sewer system also services much of the City, with about 1,100 of the City's homes currently connected. The total volume of effluent treated averages 800,000 gpd. With a design capacity of 1,300,000 gpd, the system is expected to be adequate to service the City's needs through the early 1990s. Solid waste is disposed of at a landfill operated by the Kenai Peninsula Borough (Bambard 1985).

The City Airport is serviced by three commuter airlines as well as several private charter services. The airport has a 7,575 ft (2,309 m) paved and lighted runway, VORTAC and ILS navigational aids, and is in general well equipped with amenities. The airport has been consistently upgraded, with current projects including an expanded parking area and flight service area. The City has also applied for federal funding to build a new float plane basin to service high demands by wilderness expedition companies and individuals.

The Kenai Police Department employs thirteen officers, for a relatively low population-to-officer ratio of 475:1 (Kenai Peninsula Borough 1984). Fire protection is also provided by the City, which has a fire department staffed by twelve full-time firefighters. The fire station is equipped with a 1,500-gallon crash truck, three pumpers, and a 5,000-gallon tanker. The Insurance Services Office fire service rating is five (on a one-to-ten scale), which is about average for a city of Kenai's size (Winston 1985).

Emergency medical care in Kenai is provided by the Fire Department. Patients are usually brought to the Central Peninsula General Hospital (CPGH) in Soldotna; more serious cases are treated at Anchorage hospitals (Winston 1985). CPGH, the primary health care center on the Kenai Peninsula, provides 24-hour emergency service, four-bed intensive care unit, and an obstetrics unit. The staff consists of 18 MD's, 20 RN's, and 13 LPN's. During summer 1985, the emergency room and obstetrics unit was expanded, another MD was hired, and a 16-bed chemical dependency unit was constructed.

CPGH's 45 beds have an average capacity utilization rate of 35 percent and peak use of 100 percent. Utilization has leveled off in the past year due to increased emphasis on outpatient rather than inpatient care. Demand for beds is somewhat below the national average of about 3 beds per 1000 population, due primarily to the young age of the population in the CPGH service area (Nichols 1985).

Education is provided by the Kenai Peninsula Borough School District, which operates a high school, junior high school, and two elementary schools in the City of Kenai. Total enrollment has increased from 1,252 students in October 1980 (Kenai Peninsula Borough 1984) to 1,878 in May 1985 (Overman 1985). The District employs 124 teachers at its Kenai schools, for a relatively low student-teacher ratio of 15:1 (Jewell 1985). Subject to bond issue approval by voters, a construction program would increase the capacity of Kenai's schools from 2,250 to 2,750, adequate to handle enrollment growth until about 1990, if 7 percent average annual enrollment growth occurs. In the Kenai-Nikiski-Soldotna-Sterling area, planned construction would increase total capacity to 9,475 (subject to voter approval). This increase would be sufficient to accommodate projected enrollment until the 1992-1993 school year.

4.7.1.4 Local and Regional Governance

The primary government jurisdiction in the region of the site is the Kenai Peninsula Borough. Under state law, boroughs can exercise a variety of powers, including provision of education, land use planning, platting and zoning, public safety, and other services, and may collect property, sales, and use taxes levied within their boundaries.

The Borough does not currently have a land use plan for the site area. A coastal zone management plan for the Beluga coal field area was formulated by the Borough in 1980 but was never implemented.

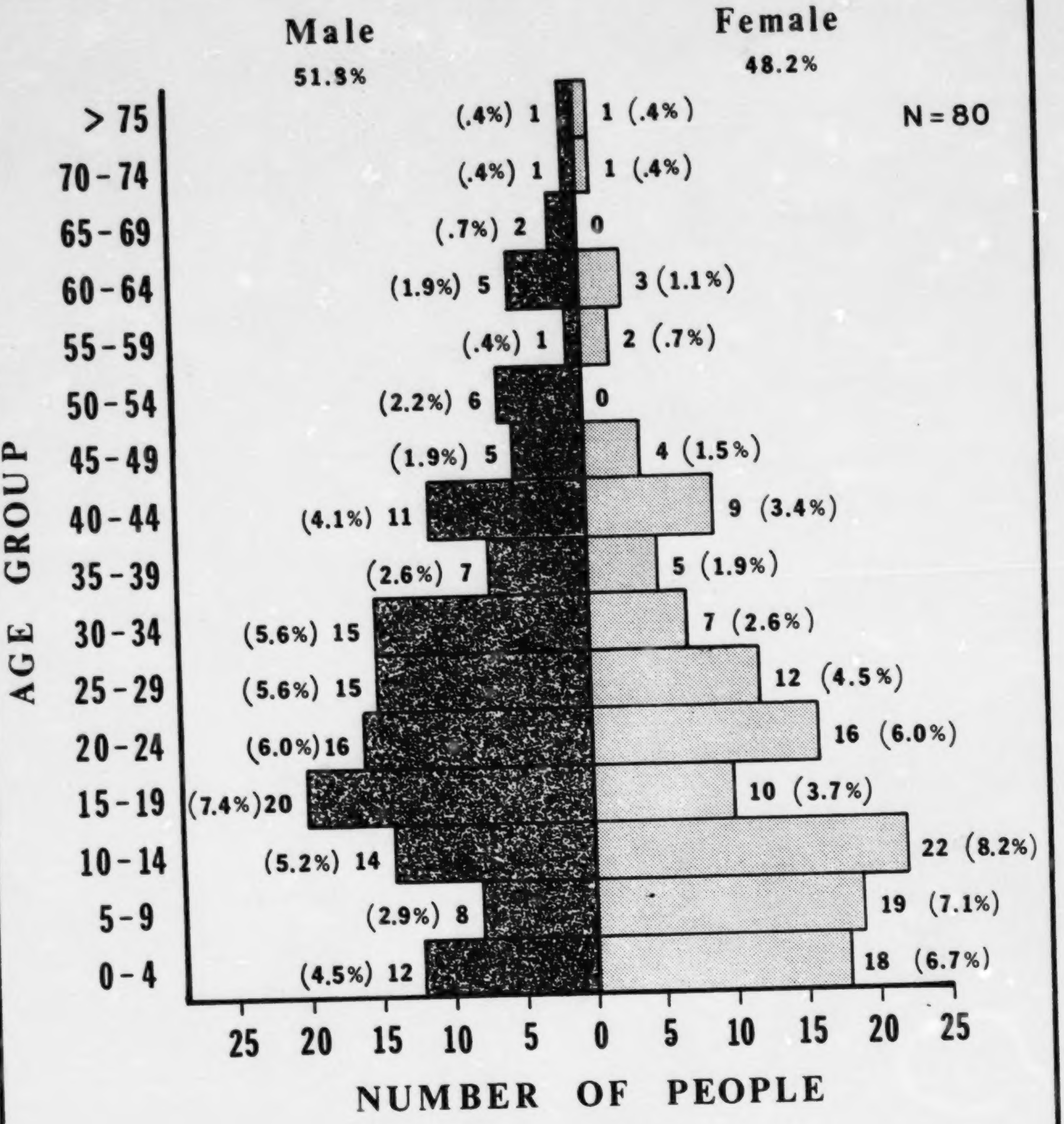
The State of Alaska is also an important government entity by virtue of its land holdings in the site area, permitting authority, and power to levy taxes on resource developments.

4.7.2 Tyonek

4.7.2.1 Demography

Tyonek's February 1984 population of 273 residents was approximately 95 percent Native (Fall et al. 1984). Village officials estimate the February 1985 population at 325 people. The rate of population growth in Tyonek has fluctuated throughout the past century (Table 4-19). The village population declined in the late 1800s and eventually crashed in 1918 as a result of a devastating influenza epidemic. Since 1920, the population has gradually increased with only a slight decline between the 1940 and 1950 censuses. In the 1960s, the town experienced a growth rate of about 2.4 percent annually. The population growth rate dropped during the 1970s, however, stagnating at about 0.3 percent annually. This decline in population growth was due to outmigration (McCord 1985) since both employment opportunities and subsistence resources were in short supply throughout the 1970s. The population has grown by approximately 3.5 percent annually between 1980 and 1984.

As presented in Figure 4-14, 78 percent of the population is under 35 years of age (Fall et al. 1984). Although this segment of the population was represented equally by males and females, the male/female ratio is disproportionate in certain age groups. There were 66 males and 45 females between the ages of 15 and 34. This may possibly be due to a higher outmigration of females. In contrast, there were 59 girls and 34 boys under 15 years of age.



SOURCE: FALL, FOSTER, STANEK. ADF&G, DIVISION OF SUBSISTENCE TECHNICAL REPORT #105. ANCHORAGE, ALASKA, 1984.

POPULATION PROFILE BY AGE AND SEX, TYONEK, FEBRUARY, 1984

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FIGURE 4-14

Table 4-19

POPULATION OF TYONEK, ALASKA, 1880-1984

1880	117
1890	115
1900	107
1920	58
1930	78
1940	136
1950	132
1960	187
1970	232
1980	239
1984	273

Source: Fall et al. 1984; Darbyshire and Associates 1981a

4.7.2.2 Economy

Tyonek residents participate in a mixed economy that requires integration of elements of both subsistence and cash production into a unified economic strategy (Fall et al. 1984). For example, cash is required to purchase equipment necessary to harvest subsistence resources. Although the two production strategies are related, their integration is often difficult. A successful renewable resource harvester must be willing to wait for suitable weather and adapt to the seasonal availability and variable migration patterns of targeted resources. This flexibility is frequently incompatible with full-time employment. Hence, employers are often faced with absenteeism and villagers must choose between work and subsistence resource harvesting. Layoffs, seasonal job fluctuations, and chronic unemployment and underemployment are perennial problems in Tyonek. This general situation was illustrated by the construction of a logging and chip mill operation by Kodiak Lumber, Mills (KLM) in 1975. Despite high unemployment and KLM's apparent desire to hire local workers, problems similar to those described above were encountered and KLM eventually found it necessary to replace much of the Tyonek work force with non-locals. By 1979, only eight Tyonek villagers worked for KLM (Braund and Behnke 1980) compared with a maximum of approximately 30 Tyonek residents employed by KLM in 1976 (McCord 1985).

Tyonek villagers had an average 1983 household income of $12,853, with the median income about $11,000 (Darbyshire and Associates 1984a). In addition, Darbyshire and Associates found that, of a total local workforce of 145 villagers, 41 held full-time jobs in 1983 (Table 4-20).

Table 4-20

TOTAL VILLAGE INCOME AND EMPLOYMENT, BY INDUSTRY
VILLAGE OF TYONEK, ALASKA, 1983[1]

Industry	Full-time	Seasonal/ Part-time	Annual Income
Commercial Fishing	0	51	$ 142,500
Construction	1	1	15,000
Cottage Industry	0	2	1,500
Transportation	1	0	14,600
Communications/Utilities	2	0	30,600
Trade/Private Services	6	2	132,825
Real Estate	0	0	33,400
Village Government	19	1	282,325
Borough School	5	6	89,455
State & Federal Agencies/Services	3	0	82,000
Total Employment in Tyonek	37	63	$ 824,205
Outside Employment[2]	4	0	73,700
Transfer Payments	—	—	258,837
TOTAL VILLAGE EMPLOYMENT AND INCOME	41	63	$1,156,742

[1] Does not include Tyonek Native Corporation jobs filled by non-villagers.

[2] Residents who leave Tyonek periodically to work outside the community.

Source: Darbyshire and Associates (1984a)

Darbyshire (1984a) estimated that an additional 63 part-time and seasonal jobs existed. Hence, 104 people were unemployed or underemployed in Tyonek in 1983, including those involved in commercial fishing and other part-time or seasonal opportunities. This high level of unemployment and underemployment is a serious impediment to the economic health of the community.

Positions with the Tyonek village council, Native Village of Tyonek (NVT) accounted for 19 (51 percent) of the 37 full-time jobs in Tyonek in 1983. These positions included: village president, equipment operators, secretaries, custodians, fire and patrol men, a nurse, health aide, and others. The Kenai Peninsula Borough employed five villagers full-time in 1983 in the school. In addition, six full-time positions were filled in private enterprises such as the local store. The remainder of the full-time positions were offered by a range of local industries including construction, transportation, utilities, and through state and federally funded programs. Changes in employment opportunities after 1983 include creation of approximately two positions in coal exploration, six carpentry positions for construction of the new tribal center, and two Chuitna River sportfish guiding businesses, one of which is based in Tyonek (McCord 1985).

The 63 possible part-time and/or seasonal employment opportunities were dominated by commercial fishing with seasonal positions available for approximately 51 people, including 26 limited entry salmon permit holders and their crew members. In 1983, 28 households derived a total income of $142,500 from commercial fishing for an average of $5,089 per household or $5,700 per permit (Darbyshire and Associates 1984a; Fall et al. 1984). In 1982, gross earnings from commercial fishing in Tyonek were slightly below 1983 fishing incomes at $4,753 per permit (Fall et al. 1984). Although data from only two years cannot be considered representative, commercial fishing earnings in Tyonek appear to be below those in other Cook Inlet fisheries. For example , gross earnings for Upper Cook Inlet set gill net permit holders averaged $9,672 per permit in 1979, $10,541 in 1980, $14,640 in 1981, $20,969 in 1982, and $16,283 in 1983 (Commercial Fisheries Entry Commission 1984).

In terms of relative contribution to Tyonek, Darbyshire and Associates (1984a) estimated private sector income including commercial fishing, village government, and transfer payments to be the most important sources of income (Table 4-21). The relationship between village government and the real estate sector of the economy requires elaboration. The Tyonek Management Corporation (TMC), a subsidiary of NVT, manages royalties from a 1965 sale of oil and gas drilling rights on the former Moquawkie Indian

Reservation. TMC invested money both locally and outside the community. In 1983, rental properties in Tyonek generated $33,400, primarily through houses leased to teachers (Darbyshire and Associates 1984a). However, rental receipts from commercial properties located primarily in Anchorage essentially supported NVT and its activities. Thus, 30 percent of the economic base of the community was derived from TMC rent receipts (Table 4-21) . Private industries (including commercial fishing, construction and merchandise) accounted for 24 percent of the economic base and public sector funding represented 46 percent of Tyonek's economic base. Although the reliance on the public sector is substantial, especially in terms of direct transfer payments, Tyonek's dependence on state and federal programs is far less than most rural Alaskan villages (Darbyshire and Associates 1984a).

Table 4-21

TYONEK'S ECONOMIC BASE, 1983

Basic Industries	Percent
Private Activities	24
TMC Rent Receipts	30
Kenai Borough School Funding	10
State and Federal Services Funding	9
State and Federal Transfer Payments	27
	100

Source: Darbyshire and Associates (1984a)

4.7.2.3 Community Facilities and Services

Due in large part to oil and gas lease income in the 1960s, Tyonek has been able to continually develop and upgrade community facilities and services to meet the needs of the community. The oil and gas royalties supported construction of new village housing in the mid-1960s and contributed to construction of the school. Investment income from the royalties has allowed continued infrastructure development to meet the changing needs of the community.

Housing needs are filled by approximately 60 prefabricated homes that Tyonek built in 1965 and 27 houses that were built in 1978-79 with funds from Housing and Urban Development (HUD) and Cook Inlet Native Association (CINA) (Darbyshire and Associates 1981b). Public utilities available to Tyonek residents include water (treated with chlorine and fluorine), telephone service, and electric service. In the late 1960s, Tyonek sold an electric generating unit to Chugach Electric Association in trade for an electricity allotment. In 1982, Tyonek's consumption was 4.7 million kilowatt-hours; by mid-1983, 11.9 million kilowatt-hours remained in Tyonek's allotment (Vecera 1985). Chugach Electric Association officials estimated that, at current rates of consumption, Tyonek would begin paying for electricity by 1986.

Sewage disposal (using septic tanks and leach fields) and solid waste disposal (at a landfill 6.4 km (4 mi) south of Tyonek) needs are filled on an individual basis. The E.L. "Bob" Bartlett School, constructed in 1967 by the Bureau of Indian Affairs and NVT and added to in 1976 by KPB, offers education for grades K-12. The school, which is operated by KPB, includes a library, full kitchen, gymnasium, and multipurpose room, as well as classrooms and offices.

A local health clinic accommodates health care needs, although residents commonly use hospitals in Anchorage for all but minor health needs. The village clinic is operated by a full-time CINA aide and a part-time CINA representative. In addition, personnel from the Public Health Service and the Alaska Native Service visit Tyonek periodically to provide health care (Darbyshire and Associates 1981b).

Other social services offered locally are administered by the NVT and supported by funds from CINA as well as various state and federal programs. These services include counseling, drug and alcohol abuse programs, day care, adult and child protection, and employment assistance (Darbyshire and Associates 1981b). In addition, CINA funds are used to support three local firemen. Public safety needs are further filled by a village public safety officer and two village security officers in Tyonek and a State Trooper in Beluga (Darbyshire and Associates 1984b; Fall et al. 1984).

Additional community facilities include a guest house/day care center, snack bar/recreation center, post office, heavy equipment shop, and community center that houses village offices (Darbyshire and Associates 1981b, 1984b). A new tribal center, funded by an HUD Community Development Block Grant, is nearing completion. It includes offices for the village government and various social service programs as well as a large public hall that will be used for village gatherings. Finally, other community service needs are filled by the private sector, including the village store and two Anchorage-based air taxi services that provide numerous daily flights between Tyonek and Anchorage.

4.7.2.4 Local Government

The Tyonek village council, under the name Native Village of Tyonek (NVT), is a federally chartered Indian Reorganization Act (IRA) council that is recognized as the local governing body for the village. The council has been active in the development of the community and its facilities for many years. Its responsibilities cover Tyonek's public affairs, public utilities, and management of village-owned lands and buildings. The Kenai Peninsula Borough administers the school and is responsible for operation of the landfill, though this function has been subcontracted to the village.

When the Alaska Native Claims Settlement Act (ANCSA) passed in 1971, Tyonek chose to participate in the Act rather than receive title to the former Moquawkie Indian Reservation. In doing so, surface title to the 10,893 ha (26,917 ac) reservation was transferred to Tyonek Native Corporation (TNC), a profit village corporation created by ANCSA, as part of its 46,621 ha (115,200 ac) entitlement. The subsurface estate of these lands was conveyed to Cook Inlet Region, Incorporated (CIRI), one of 13 regional Native corporations created by ANCSA. Although the Native Village of Tyonek can retain ownership of up to 518 ha (1,280 ac) for municipal expansion (under Section 14(c)(3) of ANCSA), these lands have yet to be conveyed (McCord 1985). Thus, NVT lost control over both surface and subsurface uses on the former reservation lands to TNC and CIRI through ANCSA. Because both TNC and CIRI are motivated in part by profits from their land and investments, there are occasional conflicts of interest between these profit corporations and the people of Tyonek (Braund and Behnke 1980).

The State of Alaska and KPB are also major land owners in the area. Although the State does not take an active role in Tyonek's local government, state land policies nonetheless affect the nature and extent of development and land use near Tyonek (for example, through issuance of coal leases). Similarly, KPB controls surface uses in the Congahbuna and Viapan Lake areas. Both of these locations have been identified as possible settlement sites in the Susitna Area Plan (Alaska Department of Natural Resources 1984). Both the State and KPB must be considered key political players in the area.

4.7.2.5 Community Attitudes Toward the Diamond Chuitna Coal Project

Previous research efforts have produced conflicting reports on Tyonek residents' attitudes toward coal development in their area. Whereas Darbyshire and Associates (1981a) found that only 20 percent of Tyonek residents opposed development of the Beluga coal fields, other studies (Braund and Behnke 1980; Pacific Northwest

Laboratory and Battelle Human Affairs Research Center 1979; DOWL 1981) indicated general disapproval for such development. As reported by these studies, Tyonek residents' concerns centered around increased outside influence on the community, disruption of their subsistence livelihood (through habitat disruption, increased competition for wildlife, or potential difficulty with access to hunting areas), and general village disruption. Field interviews conducted in January 1985 suggest that many of these concerns still prevail in Tyonek.

The January 1985 fieldwork conducted in Tyonek revealed that local attitudes toward specific aspects of the Diamond Chuitna project ranged from vehement opposition to enthusiastic support. Individuals strongly supportive of coal development invariably cited the expected increases in local employment opportunities as the major benefit to the community. Opposition to the project was based on the perceived sociocultural impacts, changes in local resource use patterns, and effects to the surrounding environment. Specifically, these concerns included:

- Effects of pollutants (especially coal dust, acidic runoff, and sewage) on fish, plants, and water quality
- Changes in fish and wildlife availability due to:
    - fish and game habitat disruption
    - stream blockage
    - increased activity that could drive fish and game away
    - overhunting by workers associated with the coal mine
    - increasingly restrictive hunting regulations should overhunting occur
    - disruption of moose migrations and traditional hunting patterns
- Disruption of the local sportfish guiding business due to increased competition for fish and reduced wilderness qualities
- Erosion of Tanaina culture and the rural way of life
- Increased outside influence in the community that could lead to:
    - loss of local control
    - increased traffic of drugs and alcohol into the community
    - increased competition for fish and game from non-locals
    - increased trespass onto Tyonek land
    - pressure for a road connection to Anchorage.

According to the interviews, the Tyonek residents who had reservations about development of the coal fields due to possible adverse social and environmental consequences realized that such development presents them with a dilemma. On one hand, they desire economic opportunities that will generate local jobs; on the other hand, they perceive the associated costs to their culture and lifestyle to be substantial. One Tyonek resident commented. "The problem is that everyone wants a job real bad, but I am kind of scared of what it will do to life here."

Some villagers voiced a need for a viable economic strategy, either based on continuation of subsistence activities (a strategy that many view as incompatible with coal development) or dominated by wage employment. These people see coal development as inevitable and want assurance that the transition into an economy dominated by coal mining is conducted in a way that allows Tyonek to participate in the development rather than be left behind and ignored. One Tyonek resident commented, "Our life is going to be changed. At least give us a chance to change with it."

Villagers who were interviewed considered the Diamond Chuitna Coal Project as one step in an on-going process of development on the west side of Cook Inlet that may eventually result in a dilution of Tyonek's culture. One Tyonek resident commented, "I'm most worried about the future and the kids and what they can expect. Before long, there will be 800 men in the Diamond camp and then Placer-Amex (sic) will come in. Pretty soon they will connect the road to Anchorage and this will be another Kenai." Another villager said, "The biggest fear is that we are going to be pushed out of this area altogether. We will be pushed into the Inlet and nobody will care."

Throughout the field interviews, parallels were frequently drawn between Diamond Chuitna Coal Company's proposal and the performance of the Kodiak Lumber Mill that operated at North Foreland in the late 1970s. According to the Tyonek interviews, agreements between KLM and Tyonek regarding worker conduct, preferential local hiring, and a no guns/no hunting policy were apparently violated, ignored, and subverted. For example, villagers indicated the no hunting policy worked until moose season opened; by 1979, few villagers worked for KLM; Tyonek Creek was blocked with sawdust and debris; the frequency of trespass increased; an ancestral cemetery was disturbed; and cables and trash were discarded on the beach and remain to this day. Tyonek residents use this recent experience as the standard for evaluating the merits of proposals to develop the coal deposits and the performance of developers in the area.

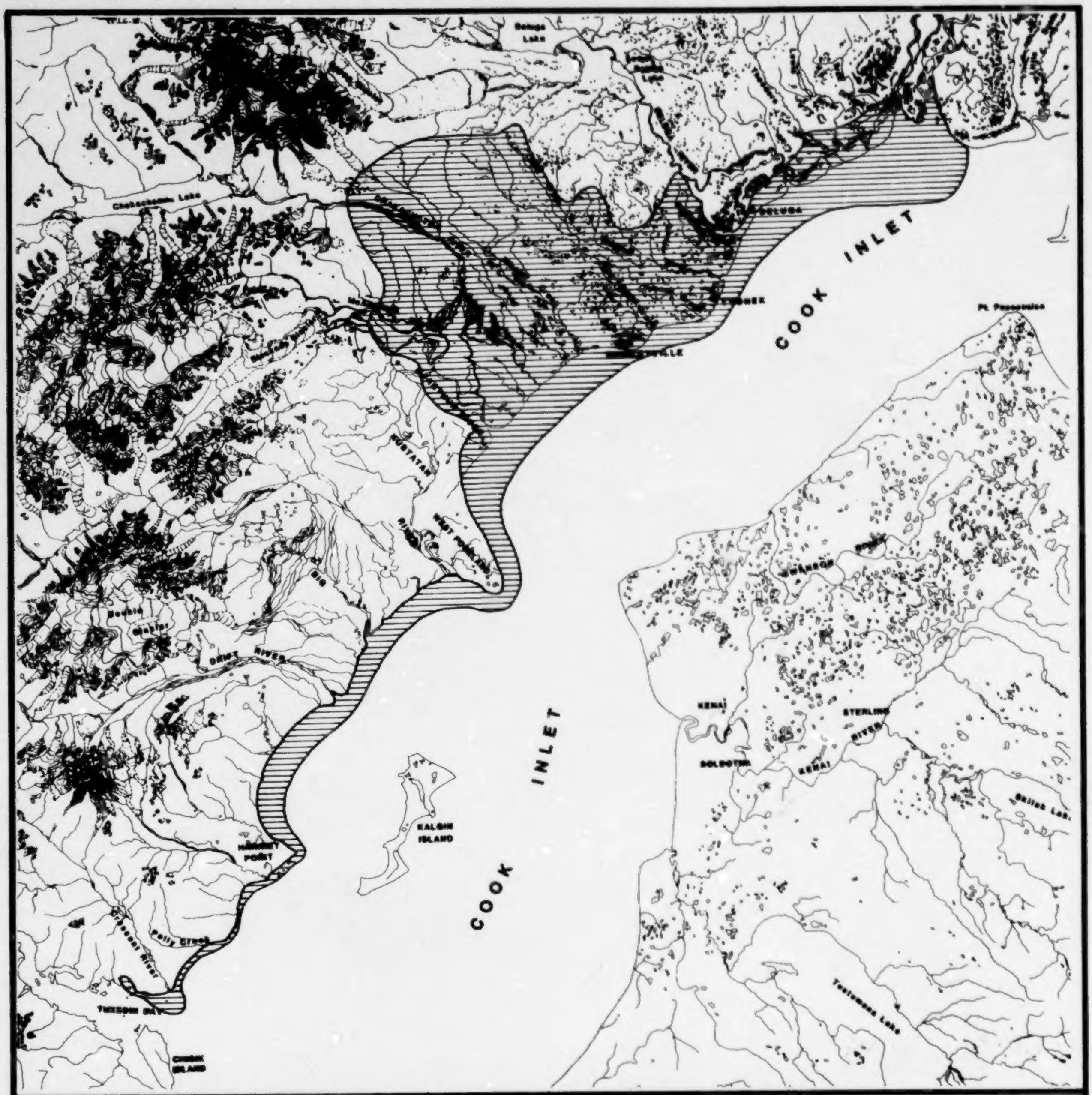
In summary, despite the advantage of enhanced local employment opportunities, many Tyonek residents were skeptical about the Diamond Chuitna Coal Project and pessimistic that any agreements will be carried out in good faith. This skepticism is in part due to the performance of KLM, but is compounded by perceptions that Tyonek is being excluded from the planning process and is powerless to affect the outcome of major land and resource use decisions for the area. One resident said, "They have planned everything off of our boundaries. It seems like they are going all around us without working with us."

4.8 SUBSISTENCE

The harvest and use of subsistence resources are important to Tyonek residents for three reasons. First, locally available wild resources are less expensive than, and often nutritionally superior, to store-bought goods. Second, subsistence resources can be a supplement or partial replacement for income derived from wage employment. As such, time and money spent obtaining subsistence resources can be adjusted depending on need, opportunities for wage employment, and success of recent cash generating activities such as commercial fishing. Finally, the harvest, use, and distribution of these resources is integrally tied to Tyonek villagers' social and cultural value system (Fall et al. 1984). Therefore, subsistence resource harvests must be viewed in light of food value, as a component of an overall economic strategy, and as a central focus of the social and cultural value system.

Figure 4-15 shows the overall resource use area for Tyonek residents from 1978 to 1984 based on a study by the Alaska Department of Fish and Game (ADF&G) from 1980 to 1983 (Fall et al. 1984). Tyonek's subsistence harvesters use a 1942.5 km^2 (750 mi^2) area generally west and northwest of the village and 217.2 km (135 mi) of coastline along the western shore of Cook Inlet (Fall et al. 1984). Methods and ease of access play a major role in determining Tyonek's use areas. Dories are used to travel along the coast and into the McArthur River flats. The road network, developed to facilitate logging and oil and gas exploration, is heavily used to access upland areas.

Although Tyonek residents harvest a wide variety of subsistence resources, moose and salmon are the most important in terms of nutritional contribution to their diet (Fall et al. 1984). In 1983, of a mean subsistence harvest of 359.6 Kg (964 lb) per household, 71 percent of the edible weight was salmon, primarily king salmon taken during a May 15 to June 15 subsistence fishing season. Moose comprise 21 percent of the 1983 edible harvest weight. The remaining 8 percent of the harvest included a variety of resources including other salmon species, porcupines (Erethizon dorsatum), berries, razor clams (Siliqua sq.), waterfowl (especially mallards [Anas platyrhynchos], pintails [A. acuta], and green-winged teal [A. crecca]),


Beluga Lake
Chakachamna Lake
BELUGA
TYONEK
COOK INLET
Pt. Possession
KUSTATAN RIVER
WEST FORELAND
BIG RIVER
Double Glacier
DRIFT RIVER
SWANSON RIVER
KENAI
SOLDOTNA
STERLING
KENAI RIVER
Skilak Lake
COOK INLET
KALGIN ISLAND
HARRIET POINT
Polly Creek
Crescent River
TUXEDNI BAY
CHISIK ISLAND
Tustumena Lake

NOTE: This map was compiled during 1982 with a sample of 39 Tyonek households, and updated in 1983-84. It represents areas used during 1978-1984. This map may be a partial representation of use areas by the community. Use areas change through time and are not fixed entities.

SOURCE: Fall, Foster, Stanek. ADF&G, Division of Subsistence Technical Report # 105. Anchorage. Alaska, 1984.

SCALE
0 5 10
miles

LEGEND COMPOSITE MAP OF ALL RESOURCE USE AREAS ▤

COMPOSITE MAP OF ALL RESOURCE USE AREAS, TYONEK, ALASKA, 1978-1984.

Diamond Chuitna Environmental Impact Statement **FIGURE 4-15**

smelt (eulachon), rainbow trout, Dolly Varden, belukha whale, harbor seal, beaver, spruce grouse (Canachites canadensis), and ptarmigan (Lagopus sp.). A variety of furbearers, including red fox (Vulpes vulpes), weasel (Mustela sp.) and beaver are trapped for furs, although trapping effort is currently lower than historical levels due to low fur prices. In addition, firewood, building timber, and coal were collected by Tyonek villagers.

The area of most intensive marine resource harvest includes marine and estuarine waters from the mouth of the Chuitna River south to Granite Point. Village fish camps and fishing sites used for both commercial and subsistence salmon harvest are located along this stretch of beach.

Intensively used aquatic and terrestrial resource harvest areas include the floodplains of the McArthur, Middle, and Chakachatna rivers; Nikolai Creek; and portions of smaller creeks in the area such as Old Tyonek Creek, Tyonek Creek, and Threemile Creek. These areas receive more intensive use than surrounding habitat due to harvest efforts on instream salmon stocks, freshwater fish, waterfowl, and moose that winter in these river valleys.

Spring, early summer, and fall are generally the busiest seasons for subsistence resource harvests. May and June are dominated by the subsistence king salmon harvest and preservation. This subsistence fishery was reopened in 1980 following a 16-year closure and originally consisted of 10 fishing periods (12 hours each) between May 23 and June 15 with a household harvest limit of 50 king salmon or a total community harvest of 3,000 king salmon. Both the season length and harvest limits for subsistence fishing in Tyonek were relaxed in 1981 to allow three 16-hour openings each week between May 25 and June 15 and 12-hour openings on Saturdays from June 16 until October 15. Harvest limits were raised to 70 king salmon and 25 salmon of other species per permit holder or 4,200 kings for the community. Subsistence king harvests have ranged from a low of 1,565 in 1982 to a high of 2,750 in 1983 (Fall et al. 1984; Stanek and Foster 1980).

Other marine resources are also harvested in the early summer including smelt, razor clams, and, occasionally, marine mammals. As the season progresses, commercial salmon fishing opens in late June and continues until the runs diminish in August and September. Although these fish are taken with commercial gear under commercial fishing regulations, a proportion of the catch is usually removed and used for subsistence purposes. As the salmon runs decline, harvest efforts are transferred to moose, waterfowl, and a variety of other resources.

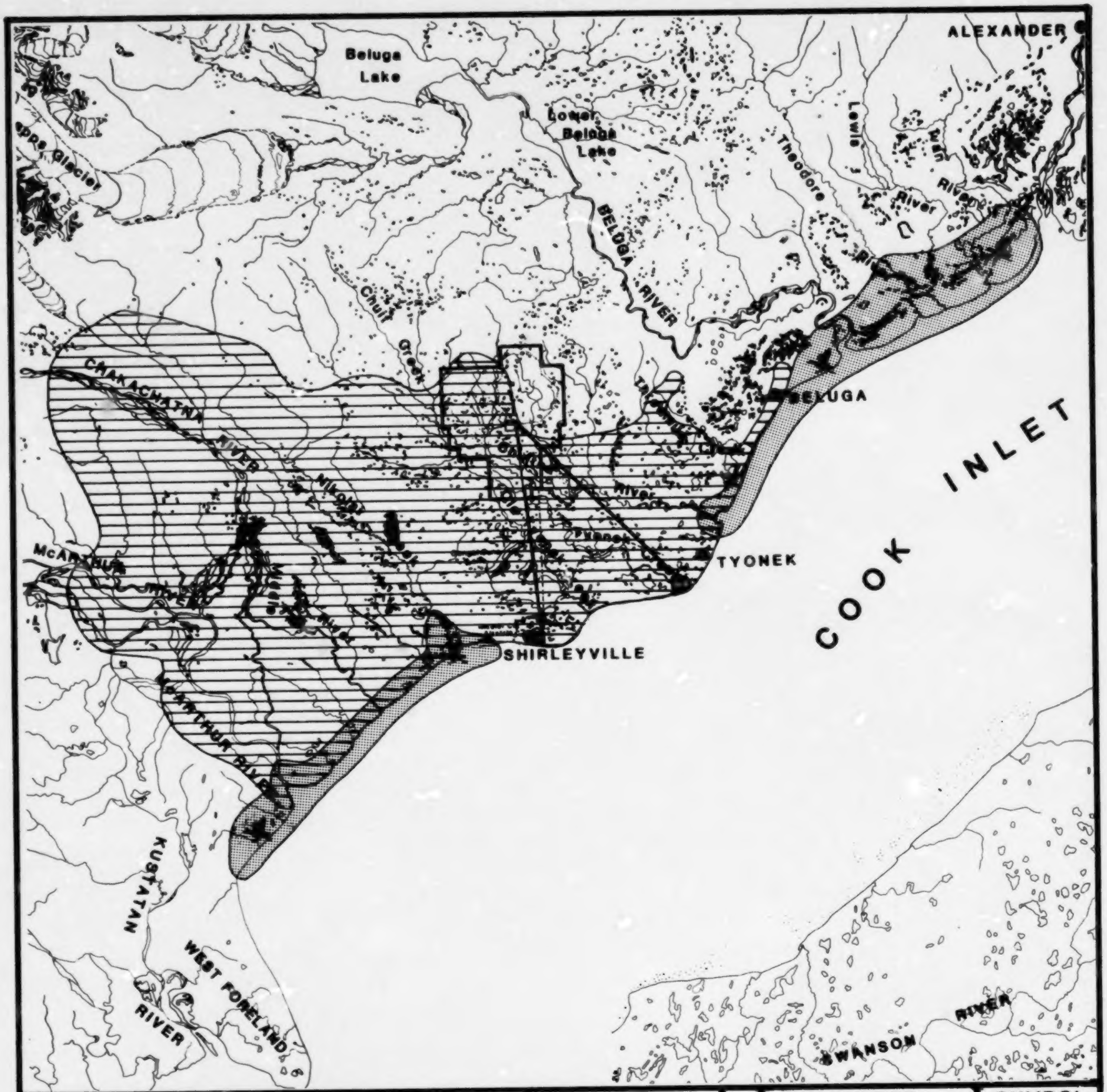
Moose hunting occurs during the general hunting seasons. Until 1976, ADF&G regulations allowed moose hunting during two seasons: August/September and November. The November season was eliminated in 1976 due to excessive hunting pressure. In 1983, moose populations had rebounded and a special November season was opened. Currently, ADF&G regulations allow openings for moose hunting in Game Management Unit 16B by local residents only between November 1 and January 31. According to ADF&G personnel, the winter moose season is opened when the snow is sufficiently deep to force the moose into more accessible lowland areas (Foster 1984). Tyonek residents stressed the importance of the winter moose season. During this time of year, moose are generally closer to the village, meat supplies from fall hunts have diminished, and competition is reduced because hunting is open only to area residents.

Figure 4-16 shows the area used for moose hunting between 1978 and 1984. Only portions of this area, however, are used in a given hunting season. Yearly variation in moose hunting areas is determined by snow conditions, moose movements, and presence of other hunters in the area.

Fall moose hunting occurs primarily in the McArthur River Flats area and along the road network. Because dories are used to access the McArthur River, this area is not used during the winter. Winter harvest effort occurs primarily between the village and the Chakachatna River (Fig. 4-14). Trucks are used to travel throughout the road network; roadless areas are accessed by foot, snowmachine, or threewheeler. Although villagers indicated they once hunted moose frequently north of the Chuitna River as far as the Beluga River, this area is currently used less than previously due to increasing competition from permanent non-Native residents, especially in Beluga. Instead, winter hunting generally takes place to the southwest and northwest of Tyonek as far as the Chakachatna River.

Hunting for other species, including porcupines, grouse, and ptarmigan usually occurs incidentally while moose hunting. These species are also sought during the remainder of the year in combination with other subsistence pursuits such as ice fishing, trapping, and firewood cutting. Tyonek hunters indicated that the abundance of small game, especially porcupines, spruce grouse, and furbearers, decreased in the late 1970s and attributed this decline to logging activities of KLM.

Areas used for trapping by Tyonek residents currently include the Nikolai Creek drainage, areas along the road between the town and Granite Point including Old Tyonek Creek, and in the area north of the Chuitna River and east of Lone Creek. In addition, a trapper who does not reside in Tyonek traps throughout a broad area north of the Chuitna River from the western boundary of the Diamond Chuitna lease area, north to Beluga Lake and east to the Susitna River.


ALEXANDER
Beluga Lake
Lower Beluga Lake
Glacier
Lewis River
Theodore River
Ivan River
BELUGA RIVER
Chuitt Creek
CHAKACHATNA RIVER
Nikolai Creek
Chuitna River
Tyonek Creek
McARTHUR RIVER
Middle River
McARTHUR RIVER
BELUGA
TYONEK
SHIRLEYVILLE
COOK INLET
KUSTATAN RIVER
WEST FORELAND
SWANSON RIVER

NOTE: This map was compiled during 1982 with a sample of 39 Tyonek households, and updated in 1983-84. It represents areas used during 1978-84. This map may be a partial representation of use areas by the community. Use areas change through time and are not fixed entites.
SOURCE: FALL et al. (1984: FIGURE 41)

SCALE 0 5 10 miles

LEGEND

RESOURCE	SYMBOL
Small Game	▤
Moose	▤
Bear	▤
Waterfowl	░

USE AREAS FOR MOOSE, SMALL GAME, BEAR, AND WATERFOWL, TYONEK, ALASKA

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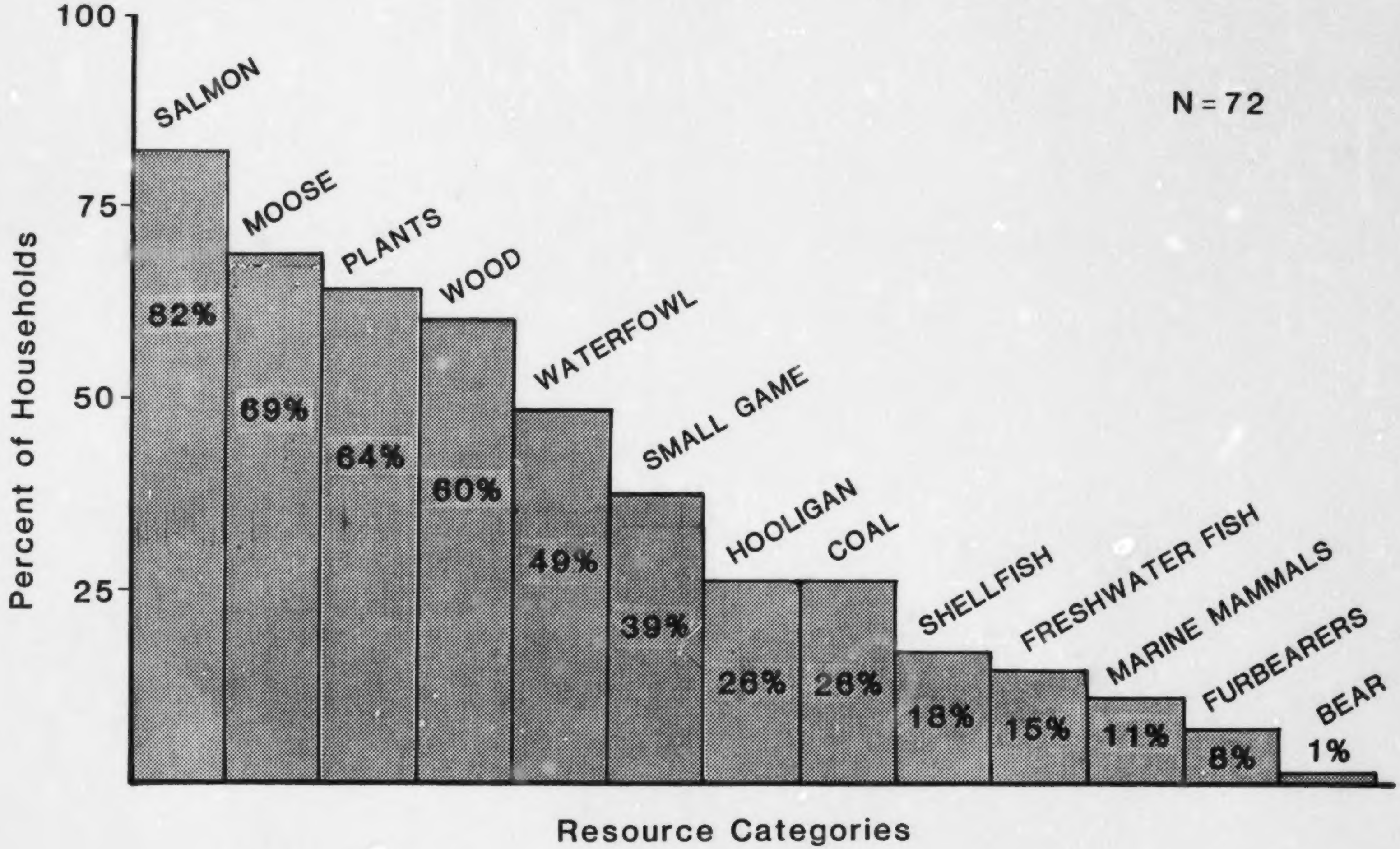
FIGURE 4-16

Eighty-two percent of the households in Tyonek harvested salmon in 1983 and 69 percent harvested or attempted to harvest moose in 1983 (Fig. 4-17) (Fall et al. 1984). Participation levels for other subsistence resources were lower than for salmon or moose. Although not all households in Tyonek participate in resource harvest activities, 90 to 95 percent of the households receive or exchange one or more subsistence resources in a given year (Foster 1981; Fall et al. 1984). Distribution of subsistence resources ensures that the benefits of subsistence harvests are dispersed throughout the community. Exchanges generally occur along kinship lines and are influenced by available surpluses, the number of dependents in a given household, and perceived need.

Cooperative harvest, use, and distribution of subsistence resources are important cohesive elements in Tyonek culture (Fall et al. 1984). The opportunity to hunt and fish is an affirmation of cultural values in an age when the dominant social, economic, and political influences tend to dilute the Tanaina culture. Continuation of traditional harvest activities, then, provides the focus of Tyonek's value system and kinship networks provide the social structure within which these traditional activities occur. Tyonek villagers want to retain these elements of their culture. It is for these reasons that Tyonek residents desire some degree of autonomy and control over the factors that influence the resources they rely on, their access to the resources, and the socioeconomic conditions that affect life in the village.

4.9 VISUAL RESOURCES

The project area is in the Coastal Trough physiographic province (U.S. Department of the Interior 1978a), which includes much of the land bordering Cook Inlet. This region is characterized by flat to rolling terrain and sparse to moderately dense vegetation. The project area is visually representative of this physiographic province, with elevations ranging from sea level at the proposed alternative port sites to about 275 m (900 feet) at the mine site and 415 m (1,360 feet) in the northwest portion of the Diamond Alaska lease area. Vegetation is generally of moderate density, consisting primarily of open mixed woods of birch and spruce in the uplands (9 to 12 m in height [30 to 40 feet]), and muskeg in the depressions and lowlands. Above 153 m (500 feet) in elevation are willow and alder shrub communities which may reach 6m (20 ft) in height. Numerous drainages and depressions exist on the site, which in combination with vegetation provide good, but not complete potential for screening of project facilities from view of the occasional visitors to the area.



SOURCE: FALL, FOSTER, STANEK. ADF&G, DIVISION OF SUBSISTENCE TECHNICAL REPORT #105. ANCHORAGE, ALASKA, 1984.

PERCENTAGE OF TYONEK HOUSEHOLDS ATTEMPTING TO HARVEST RESOURCES BY RESOURCE CATEGORY, FEBRUARY 1983–JANUARY 1984

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FIGURE 4–17

The mine site and other proposed facility areas are rarely viewed due to their remoteness from inhabited areas and the low use level of nearby land and water. Lands near the proposed port sites can be viewed from nearby areas on Cook Inlet where occasional commercial, subsistence, and sport fishing occurs. Recreational use of the project area is described in Section 4.10.

Visual quality of the project site area was assessed using the U.S. Bureau of Land Management Visual Resource Management (VRM) System (U.S. Department of the Interior 1978b). The terrain unit (viewshed) used for the analysis consisted of a triangular area extending from Granite Point to North Forelands to the mine area. Because of the visual screening available from topography and vegetation, the viewshed included lands about 2 miles on either side of the proposed transportation corridor alternatives and 5 miles on either side of Granite Point and North Forelands.

As shown on Table 4-22, the scenic quality rating assigned to the area is 19 on a scale from 0 to 33. This rating is in Class A (of classes A, B, and C), which includes ratings between 19 and 33. According to the BLM criteria for categorization of an area as a potential area of critical environmental concern regarding scenic values, the scenic quality rating must be Class A and must have a scarcity rating of 5 or 6. Therefore, the project area would not qualify under these criteria. However, the Class A rating implies that some special management attention to maintaining the area's scenic quality may be merited.

Table 4-22

SCENIC QUALITY RATING FOR THE PROJECT AREA

Category		Score	Possible Range
Landform		3	1-5
Vegetation		3	1-5
Water		3	0-5
Color		3	1-5
Influence		3	0-5
Scarcity		2	1-6
Cultural Modification		2	-4-2
	Total	19	0-33

The area's remoteness from large communities or activity centers tends to lower the level of concern for visual intrusions. However, an important use of the area is for wilderness expeditions such as fly-in fishing and subsistence use, for which lack of man-made visual intrusions is an important attribute. Addition of this user attitude factor would tend to raise overall concern for visual changes to the area. The net effect of low use level and high user concern is assessed as neutral and the scenic quality rating of 19 is considered representative of the overall sensitivity of the project area to change.

It should be noted, however, that a common vantage point is not from the ground, but from the air, since most travellers who see the site area fly in. Thus, the viewshed is actually larger if aerial vantage points are included. If a larger area were considered to reflect aerial views, the visual sensitivity of the area would be somewhat lowered because "cultural modifications" such as logging roads, the Beluga power station, and power lines are more visible from the air. The presence of these man-made influences tends to lower scenic quality ratings according to the VRM methodology.

4.10 RECREATION

The primary recreational uses of the site and its environs are fly-in fishing expeditions, non-subsistence moose hunting, and some hiking, camping, and picnicking by Tyonek residents (see Section 4.8).

4.10.1 Sport Fishing

The project area, particularly the Chuitna River, provides excellent coho and king salmon fishing. The Chuitna is open for coho salmon fishing in its entirety and, since 1983, has been open for king salmon from Cook Inlet to the mouth of Lone Creek. These areas are accessible from Tyonek and nearby airstrips via abandoned logging roads and are fished during June-July for king salmon and July-August for coho. While there is good potential for a rainbow trout fishery on the upper Chuitna, lack of access probably limits use of upstream areas. However, good rainbow fishing is available on the lower Chuitna early in the season. Kings and red salmon are also taken in this area.

At least two wilderness fishing operations regularly use the permit area. Clients are picked up at the Tyonek or Superior airstrip and driven to the Chuitna River or Lone Creek, then picked up at day's end. One operator has developed a trail network along the river banks and has built a lodge near the Chuitna River-Lone Creek confluence. Permit area waters are seldom fished. Although good fishing is available, fishing guides do not use either Nikolai or Threemile Creek, which are fished primarily by local residents for kings and red salmon.

In 1983, between 4,000 and 5,000 man-days of fishing effort are estimated to have been spent in Western Cook

Inlet (including all streams north of the MacArthur system and south of the Lewis River). Most of this effort was on the Chuitna River. The king salmon fishery accounted for approximately 2,000 man-days of this total (the 1984 king salmon run attracted a similar level of use). The Chuitna River king salmon fishery is excellent, with harvest rates over 0.5 fish per man-day. The Chuitna River king salmon population is presently underharvested (Hepler 1985). The Chuitna River coho salmon fishery attracts somewhat lower fishing effort, but probably still accounts for most of the 4,000 to 5,000 man-days spent in Western Cook Inlet not represented by king salmon. No data are available on the level of effort for rainbow trout (Delaney 1985).

4.10.2 Hunting

Sport hunting in the project area is largely restricted to moose hunting. Waterfowl may be taken opportunistically on lakes in the area, but most waterfowl hunting takes place in the Trading Bay or Susitna Flats State Game Refuges. Brown bear are not harvested except occasionally in "defense of life and property." In the vicinity of the Beluga River, approximately twenty hunters per year hunt black bear. There are no statistics available to indicate success. Ptarmigan are also occasionally hunted in the area.

Moose hunters number about 150 per year. Hunters usually arrive in Tyonek by air or boat and hunt from the road system. Tyonek residents provide some support facilities for hunters in their area. Hunts are held in the fall and in the winter. In 1984, ADF&G issued 48 permits for the winter moose hunt and in 1985, 67 permits were issued. Statistics indicate there is an approximate hunter success rate of 25 to 50 percent. It should be noted that a winter sport hunt for moose has not been held since 1985.

4.10.3 Other

Other possible recreational uses of the project area include recreational trapping and waterfowl hunting by non-Natives and picnicking, camping, and sight-seeing by the Tyonek villagers. Data on recreational trapping and waterfowl hunting by either Natives or non-Natives is unavailable, but some occasional use may occur.

4.11 CULTURAL RESOURCES

The Diamond Chuitna project area lies within a region of Alaska where relatively few archaeological sites have been discovered and even fewer scientifically excavated. Current understanding of the region's cultural history is sketchy due to the lack of data. It appears as if the earliest human use of the Cook Inlet area was sometime between 8,000 and 10,000 years ago. The lowest level of the

Beluga Point site, on the north shore of Turnagain Arm, produced core and blade materials in an undated context; similar materials from sites elsewhere have been assigned to the American Paleoarctic Tradition of about 10,000 years ago (Reger 1977, 1981). The next known occupation of the region, also represented at the Beluga Point site, is characterized by material dating to about 3,000 years ago, which apparently does not have obvious relationships to cultural remains elsewhere in Alaska.

Two cultural manifestations at the Beluga Point site date between 3,000 and 1,500 years ago. The earliest probably is related to the Norton culture and thus may be connected with an intrusion of Eskimo peoples or cultural traits into the area. Other sites from the same time period and possessing similar collections of cultural material are known from the general area, particularly to the north. The later complex is not well represented but may be similar to a cultural manifestation known from Bristol Bay and dating to about 500 B.C. (Ross 1971).

The late period of prehistory is represented by several sites in the general project area, including Beluga Point where the uppermost level dates to around 600 years ago. Historic sites, occupied first by the Russians, later the Americans and, throughout the period, by the Tanaina Athapaskans (the Native people inhabiting the region at the time of contact) are common in the region, though few have been extensively excavated.

Only one archaeological site is known to be present in the Diamond Chuitna project area (Gerlach and Lobdell 1983). The site is located on the elevated bluff above Cook Inlet in the Granite Point area within the confines of the coal storage area proposed by Diamond Alaska at the port site. Shallow depressions, probably representing salmon storage pits, were reported at the site (TYO-064). Further testing might disclose evidence of habitation features or debris. Archaeological survey did not disclose any other materials attributable to past human use of the immediate project area. The remains of historic cabins are located adjacent to the Ladd port site (TYO-033). The cabins, which are greatly deteriorated, are frame and log structures. No archaeological investigations have been carried out in the Northern transportation corridor. However, the nature of the terrain and the extensive vegetative cover suggests the possibility that other archaeological sites may exist.

Chapter 5.0

Environmental Consequences

5.2 THE NO ACTION ALTERNATIVE

The No Action alternative would result if at least one of the permits necessary for project development were denied or if the project sponsor chose not to undertake the project. No Action would mean that none of the activities described in Chapter 2.0 would occur. In addition, ongoing exploration activities would likely stop and Diamond Alaska would probably be required to rehabilitate existing disturbed areas. None of the impacts to the physical and biological environment described in the remaining sections of this chapter would occur and the area would essentially retain its relatively undeveloped character. Some development scars from past exploration would remain in the coal field vicinity for an indefinite time period, but they would become less conspicuous with the passage of time.

Not developing the Diamond Chuitna Coal Project could create a future need for coal mines at other locations. The extent of this need would depend on local and worldwide conditions of supply and demand. If substitute mines were developed, environmental impacts of unknown, but possibly significant, magnitude could occur at some other location(s). Whether or not the impacts would be greater or less than those that would occur at the Diamond Chuitna site cannot be determined.

If it is assumed that the No Action alternative would cause Diamond Alaska to cease exploration and predevelopment activities, then the small number of jobs that are currently supported by these activities would be lost and Diamond Alaska would turn its energies elsewhere. Failure to proceed with mine development would result in at least 848 permanent jobs not being realized over the 34-year life span of the mine. The various positive and negative socioeconomic impacts to the village of Tyonek and Kenai Peninsula communities described in subsequent sections of this chapter would not occur.

From a regional standpoint, not developing the Diamond Chuitna mine could significantly affect the course of future development in the area. Development of the project and its infrastructure would likely serve as a stimulus for development of other coal fields as well as providing the economic base for support and other industries (see Section 5.7). The No Action alternative would prevent or delay industrial development of the Beluga area and tend to maintain the present character of the area.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 INTRODUCTION

The scientific and analytical bases for the comparison of alternatives summarized in Section 3.2.4 are presented in this chapter.

The No Action alternative is discussed first. Since for almost all disciplines, the impact of the No Action Alternative would be the status quo, impacts of this alternative are not discussed for each of the individual disciplines. Rather, the No Action alternative is discussed in a separate section (Section 5.2) which deals primarily with the socioeconomic impacts of no project implementation.

Section 5.3 discusses the impacts of components common to all action alternatives, i.e. impacts associated with the mine, overburden stockpile location, and mine service area. Impacts are considered for each discipline. Next, the chapter deals with the applicant's Proposed Project, which includes two port site/transportation corridor alternatives. Finally, several additional alternatives are discussed, including an eastern corridor/Ladd alternative and three housing area configurations.

The environmental consequences described for the action alternatives in this chapter assume that the level of mitigation would be as proposed by the applicant (Chapter 2.0). One of the alternatives available to the permitting agencies is to request additional mitigating measures as a condition of their respective permits. Possible mitigation measures beyond those proposed by the applicant and the environmental consequences of their implementation are discussed separately in Chapter 6.0.

Throughout the following impact discussion, various references are made to "local" impacts and "regional" impacts. For purposes of this EIS, "region" refers to the Beluga Region or the area roughly outlined in Figure 4-1. Local impacts refer to effects that occur at, or immediately adjacent to, proposed project facilities. Therefore, impacts that are "regionally significant" would normally be noticeable or measurable when considered from a regional perspective. "Locally significant" impacts would be noticeable or measurable in the vicinity of the impact but would not be noticeable on a regional basis. Regionally significant impacts could have significance on a broader scale (statewide or national) if the magnitude were large enough or the resources particularly sensitive.

5.3 IMPACTS COMMON TO ALL ACTION ALTERNATIVES - MINE AND MINE FACILITIES

5.3.1 Impacts to Terrestrial Environment

5.3.1.1 Physiography and Geology

The major construction and operation impacts of the proposed project on physiography, geology, and soils are related to coal and gravel extraction and gravel placement for facilities and for roadway and drainage structures. Four sites (Fig. 2-16) have been selected as potential gravel mining sites. These sites would provide a maximum of 4.3 million m^3 (5.6 million yd^3) of material and riprap which would be required for facilities foundations, roadway and drainage embankments, drainage structure protection, and reclamation. Extraction of coal, gravel, and rock would deplete portions of valuable resources. The above figure includes approximately 3060 m^3 (4000 yd^3) riprap, 459,000 m^3 (600,000 yd^3) gravel or road surface material and 2.3 million m^3 to 3.8 million m^3 (3 to 5 million yd^3) unclassified fill. The impacts of specific components are discussed in the following paragraphs.

Mining operations would deplete approximately 299 million Mt (330 million short tons) of coal. A 16.8 million m^3 (22 million yd^3) overburden stockpile would be created from overburden and interburden from the initial box cut for the mine. Approximately 81 ha (200 ac) would be covered by the overburden stockpile. Consideration has been given to the stability of the overburden stockpile slopes and future slope failures on the waste pile would not be anticipated with the proposed configuration.

The earth-moving sequence proposed by Diamond Alaska would replace materials in approximately the same order as their removal. However, it is anticipated that significant mixing of overburden and interburden would still occur during their extraction and replacement in depleted portions of the mine pit. Therefore, the postmining stratigraphic sequence would be similar to, but not identical to, the premining condition.

The surface excavation required to remove the coal would substantially alter the topographic relief during mine operation. As described in Section 2.3.2, the pit face would be continually advancing as new overburden is removed. The trailing edge of the pit would also advance as overburden is dumped onto mined-out areas. In effect, a 182 ha (450 ac) hole in the ground would move across the landscape over a 30-year period. The reclaimed area behind the mine pit would be regraded to its approximate premining topography as the pit advances and, at completion of mining, the whole area would be restored. Postmining topography would be similar, but not identical, to the premining condition.

5.3.1.2 Soils

Clearing and grubbing operations for the mine and mine service facilities would directly disturb over the life of the mine about 2,050 ha (5,066 ac) of mainly organic soils, including 1,127 ha (2,785 ac) of Mutnala-Chichantna, 548 ha (1,354 ac) Mutnala, and 284 ha (702 ac) Starichkof soil types (see Tables 4-1 and 4-2 for characterizing features of the affected soils)(Bechtel 1982).

The 10-year mine area consists of 1,436 ha (3,546 ac) of which 1,047 ha (2,585 ac) or 73 percent consists of Strandline soils that have a sandy loam texture (ERT 1984d). Because of their mineral nature, these soils are valuable for revegetation. Peaty Starichkof - Chichantna soils occur on 366 ha (905 ac) of the 10-year mine area. The remaining 23 ha (56 ac) consists of Jacobsen sand and Killey - Moose River silt loams.

Because of the long period required for soil formation, soils in the Diamond Chuitna mine area are highly susceptible to irreversible, disruptive impacts from surface mining. A major long-term disturbance would result from the removal of soils and overburden to reach the coal seams.

The initial construction impact to soils would be eventually mitigated by implementation of the reclamation plan and successful revegetation. The revegetation medium would be provided by backfilled overburden with a minimum 6-inch layer of redistributed topsoil. The development of a favorable growth medium would be facilitated by addition of fertilizer and control of accelerated erosion. Development of a biologic (i.e., biologically mature) dynamic soil profile from overburden equivalent to that which currently exists would require a long time period (hundreds of years) in this subarctic climate (Douglas and Tedrow 1959; Heilman 1966; Brady 1974). The addition of a topsoil layer containing biologic components as currently planned would greatly accelerate the process of soil evolution. Thus, construction, operation, and reclamation impacts of the project on existing soils would be a long-term, but partially reversible commitment of the resource. It should be noted that a successful revegetation program, including attainment of a diverse and productive community, is not necessarily dependent upon the development of a mature soil profile. Test plots in the mining area are designed to establish the most favorable reclamation conditions.

5.3.1.3 Vegetation

Community Composition

During construction and operation, clearing for the mine would directly disturb about 2,029 ha (5,014 ac) of existing vegetation, including 1,356 ha (3,351 ac) of mixed spruce-birch woodland, 364 ha (899 ac) of open low shrub scrub/sweetgale-grass fen, and 182 ha (450 ac) of closed alder/tall shrub scrub (ERT 1985e). An additional 22 ha (54 ac) of primarily mixed spruce-birch woodland vegetation would be disturbed by construction of the mine service facilities (Table 5-1).

Vegetation would also be disturbed by mining of gravel, the extent of which would depend on the number of sites used (Fig. 2-16). Site 5 would disturb about 106 ha (262 ac) of mainly mixed spruce-birch woodland vegetation. Sites 8 and 7 would disturb 134 ha (331 ac) of mixed spruce-birch woodland and mesic graminoid herbaceous/bluejoint herb vegetation and 119 ha (294 ac) of mainly mixed deciduous woodland vegetation, respectively.

Damage to vegetation could also occur from fuel and chemical spills. The degree of impact would depend on the amount of the spill, the time of the year, type of community, and type of action required for the cleanup (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or those occurring in winter. Spill contingency plans and engineering design will help to prevent or minimize damage.

Another possible indirect impact would be the increased risk of spruce beetle infestation of native trees resulting from the spread of beetles in piles or windrows of trees created during clearing operations. Delayed burning of dead trees would increase this risk.

The use of topsoil as a revegetation growth medium would facilitate the establishment of vegetation and would reduce the time and effort required to attain a self-sufficient plant community (McGinnies and Nicholas 1980). Revegetation studies by Diamond Alaska on test plots in the mine area have indicated that early successional species (e.g., grasses) will readily grow on typical overburden materials even in the absence of topsoil. Estimation of the time required to attain a plant community with a similar structure and diversity to premining conditions (or a successional stage leading to such) requires extrapolation of data from similar areas and project development circumstances. Because no data are directly

Table 5-1

AREA (ha [ac]) OF VEGETATION DISTURBED BY VARIOUS MINE COMPONENTS

	Vegetation Unit[1]									Total
Project Component	1	2	3	4	5	6	7	8	9	Area (Ha[ac])
Mine and Mine Facilities										
Mine	-	-	-	20 (49)	1356 (3351)	-	182 (450)	364 (899)	101 (250)	2029 (5014)
Mine Service Area	-	-	-	-	14 (35)	-	-	8 (20)	-	22 (54)
Housing Facilities and Airstrip (Lone Creek)	-	-	-	-	(62) 25	-	(4.9) 2	(2.5) 1	(2.5) 1	(72) 29
TOTAL	-	-	6 (14.8)	20 (49)	1395 (3447)	-	184 (455)	373 (922)	102 (252)	2080 (5140)

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[1] Vegetation Units (ERT 1985e) are as follows:

1 - Closed broadleaf forest/paper birch
2 - Open broadleaf forest/balsam poplar
3 - Open mixed forest/spruce-birch
4 - Needleleaf woodland/black spruce
5 - Mixed woodland/spruce-birch
6 - Open tall shrub scrub/willow
7 - Closed tall shrub scrub/alder
8 - Open low shrub scrub/sweetgale-grass fen
9 - Mesic graminoid herbaceous/bluejoint herb

transferable to the Diamond Chuitna Project, conservative estimates of time required for soils and vegetation regeneration have been obtained by a review of literature documenting natural and man-assisted succession.

The time period required for vegetation reestablishment varies with ecosystem (climatic regime) and site conditions. In the absence of reclamation, secondary succession to attain premining vegetation biomass on overburden would require an estimated 20 to 40 years. This estimate is based on regeneration data, including studies on secondary succession and revegetation after complete soil disturbance. Natural regeneration after logging to an early successional Canada bluejoint grass community occurs relatively quickly in the project area (ERT 1984g). However, vegetation regeneration on highly disturbed soil would be expected to require a somewhat longer period. Natural vegetation, including the establishment of willows and black cottonwood, occurred within 25 years on newly exposed glacial till and a nearly continuous cover of alder had established after 35-40 years in the moist environment of Glacier Bay (Crocker and Major 1955). Younkin and Martens (1985) indicate reinvasion of native species including trees and shrubs after four years on fertilized mine overburden in a boreal forest ecosystem in Canada (61 degrees latitude). Unassisted revegetation (20 percent cover) was attained in the same time frame in the Yukon Territory (64 degrees latitude) on pipeline overburden (Younkin and Martens 1985). Willow and alder with an herbaceous understory have established within 20 years after fire in central Alaska (Lutz 1956). However, the establishment of a diverse, relatively mature community from natural succession alone could take 50 to 100 years (Rowe and Scotter 1973; Hettinger and Janz 1974).

Implementation of reclamation procedures as currently planned would facilitate and accelerate the reestablishment of self-perpetuating plant communities on disturbed sites within the project area. Using results of previous work (Younkin and Marten 1985; Crocker and Major 1955; Lutz 1956; Vierick 1982), it is postulated that well-developed stands of herbaceous and shrub vegetation would be established 5 to 10 years after commencement of reclamation. Self-perpetuating vegetation with sufficient cover to prevent erosion could probably be established within 10 to 20 years after reclamation. The establishment of mature shrublands and young forests would require an estimated 20 to 30 years. Reestablishment of woody communities, species diversity, and wildlife values similar to existing communities, however, could require a longer period (20 to 40 years). The use of topsoil as a revegetation growth medium would tend to shorten the time needed to obtain a self-perpetuating plant community.

Long-term adverse impacts on vegetation would occur in areas that are cleared and used continuously during mining. Reclamation operations could not be implemented until the mine service area and other mine facilities were dismantled. Thus, reestablishment of vegetation would not occur until 10 to 15 years after project completion.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the mine area.

5.3.1.4 Wetlands

Of the total area directly altered by clearing for and construction of the mine and mine facilities, 545 ha (1361 ac) or 27 percent is classified as wetlands according to the criteria presented in Section 4.3.2.3 (Table 5-2). In addition to direct adverse impacts, wetland structure and function would be altered adjacent to project facilities by blockage of natural drainage patterns and disturbance of wetland inhabitants.

Ponding and dewatering of wetlands adjacent to development areas such as road-fills can occur where the fill is perpendicular to the natural flow of water through the wetland and cuts off the flow. The result can include the drying up of the wetland on one side of the fill to varying degrees and flooding of the other side. This type of impact has been most pronounced in relatively flat permafrost areas where the active soil that allows water movement is very shallow. The Diamond Chuitna area is not a permafrost area and has enough topographic relief that the ponding/dewatering will not be widespread. Much of the potential impact can be prevented by proper placement and maintenance of culverts.

Some wetland areas would probably become reestablished in low areas following reclamation of the mine area. However, because of unknowns regarding postreclamation soil permeability and water tables as well as the long period of evolution that is required to create natural peatlands with their inherent water holding capacity, it is likely that the extent of wetlands would be much smaller following reclamation than prior to mining. Most wetlands within the reclaimed mine area would lack the peat and organic material which characterize the existing wetlands. Mineral soil substrate with sparse sedges and grasses would initially predominate in wet areas. In the very long term (hundreds of years), organic matter would accumulate and some peat growth would probably occur, bringing the area closer to its initial condition. As a partial mitigation measure to offset this loss of peatlands,

Table 5-2

HECTARES (ACRES) OF WETLAND LOST AS A RESULT OF MINE DEVELOPMENT BY PROJECT COMPONENT

Components	Wetland Type[1] $PFO\frac{4}{1}$	$P\frac{SS1}{FO4}$	PFO4	PSS1	$P\frac{SS1}{EM5}$	PEM5	POWH	TOTAL
- Mine Components								
30 year mine limit [2]	59.3ha(148ac)	–	12.4ha(31ac)	24.0ha(60ac)	348ha(869ac)	47.3ha(118ac)	50.6ha(127ac)	541ha(1353ac)
Mine Service Area	0.4ha(1ac)	–	–	2.8ha(7ac)	–	–	–	3.2ha(8ac)
- Transportation Corridors[3]								
Southern Corridor haul road & conveyor system	3.0ha(7.6ac)	–	0.1ha(0.2ac)	0.1ha(0.2ac)	4.3ha(10.8 ac)	0.5ha(1.3ac)	0.2ha(0.5ac)	9.1ha(22.2ac)
Material Sites								
(a) #5	–	–	–	–	1.2ha(3ac)	–	–	1.2ha(3ac)
(b) #7	–	–	–	–	–	–	–	–
(c) #8	–	–	–	0.8ha(2ac)	1.6ha(4ac)	0.4ha(1ac)	–	2.6ha(7ac)
Eastern Haul Road and conveyor systems	0.2ha(0.6ac)	–	–	–	1.8ha(4.5ac)	–	–	2.0ha(5.1ac)
Northern Haul Road and conveyor system	0.5ha(1.2ac)	12.2ha(30.6ac)	–	–	2.6ha(6.4ac)	0.4ha(1ac)	–	15.7ha(38.8ac)
- Housing & Airport Facilities								
Lone Creek Site	–	–	–	–	2.4ha(6ac)	–	–	2.4ha(6ac)
Congahbuna Lake Site	–	–	–	–	2.4ha(6ac)	–	–	2.4ha(6ac)
Threemile Site	–	–	–	–	–	–	–	–
- Port Facilities								
Granite Point	–	–	7.8ha(19.6ac)	–	70.5ha(176.2ac)	–	1.2ha(3ac)	79.5ha(198.8ac)
Ladd Port Site	2.4ha(6ac)	8.4ha(21ac)	–	–	–	–	2.4ha(6ac)	13.2ha(33ac)

NOTE: Wetland area figures may not correspond exactly with areas in the vegetation sections because the two mapping efforts differed.

1) $PFO\frac{4}{1}$ Palustrine - Forested mixed needle leaved/broad deciduous

$P\frac{SS1}{FO4}$ Palustrine - Scrub-shrub/Forested broad leaved deciduous

PFO4 Palustrine - Forested broad leaved deciduous

PSS1 Palustrine - Scrub-shrub broad leaved deciduous

$P\frac{SS1}{EM5}$ Palustrine - Scrub-shrub broad leaved deciduous/Emergent narrow leaved persistent

PEM5 Palustrine - Emergent narrow leaved persistent

POWH Palustrine - Open water permanent

2) Includes overburden stockpile

Diamond Alaska plans to include establishment of 2 to 5 acre peat-filled depressions as part of their reclamation plan. In addition, reclaimed sedimentation basins would be selectively revegetated to accelerate the buildup of organic components. These experimental measures would alleviate wetland impacts to some extent but would cover a small surface area compared to the area of existing wetlands.

Wetland-related impacts to vegetation and wildlife for each alternative are presented in subsequent sections. The following paragraphs address wetland impacts in relation to the special values presented in Section 4.3.3.

Most wetland-related plant and animal productivity would be lost during operations, for a substantial period thereafter, and possibly indefinitely depending on the success of wetland reclamation. The acidic, muskeg-type wetlands which are widely dispersed throughout the area are not especially productive and the net primary productivity of replacement communities would probably be as high or higher than the communities which now exist. Therefore, adverse impacts resulting from overall loss of primary productivity would probably not be significant on a regional scale. Food webs would be interrupted locally (in the immediate vicinity of the disturbed wetland), but such interruption would probably not be significant on a regional basis because of the isolated nature of most area wetlands and the presence of similar wetlands outside the project area.

Wetland habitat available for wildlife use within the disturbed areas would be reduced. For the most part, the wetlands in the project area are not themselves high value habitat, but the habitat diversity and forest edge associated with the interspersed wetlands contributes significantly to the overall moderate to high value of the area to wildlife, especially moose and bears. Postreclamation habitat value for moose and black bear could be less than premining (Section 5.3.1.5 and Appendix A) partly because of loss of habitat diversity now contributed by wetlands.

Significant impacts to local hydrological regimes would occur as a result of eliminating, reducing, and altering wetlands in the mine area (Section 5.3.2.1). Wetland areas affect the hydrological characteristics of their watersheds in a variety of ways depending on wetland characteristics. Wetlands in the mine area store large quantities of water and play an important role in surface water - ground water interactions (ERT 1984c). The baseline investigations indicated that the deep organic layer underlying the muskeg areas on the sides of the stream valleys forms a shallow ground-water system that contributes the majority of base flow to the streams in and adjacent to the mine area. Removal of the vegetation and organic soils would destroy this shallow system and potentially prevent restoration of streams to premining conditions. Removal of wetlands would probably also increase flood peaks in the Chuitna drainage to some extent (Carter et al. 1978); however, saturated peatlands tend to respond quickly to precipitation events and the impact of removing the muskeg would probably not be dramatic (Verry and Boelter 1978). Recharge rates within the deeper ground-water systems could be increased after mining because deep organic deposits can inhibit percolation; evapotranspiration within wetland communities removes substantial water that would otherwise be available for recharge (Carter et al. 1978). Lone Creek and Stream 2003 could be affected (Section 5.3.2.1), resulting in lower minimum flows and higher peak flows.

The removal of wetlands would cause long term alteration in the quality of surface-water runoff from the mine area. Wetlands tend to remove suspended sediment from inflowing waters (Carter et al. 1978); therefore, postreclamation runoff would likely contain more sediment than at present which could affect long-term stream water quality. Peatlands also tend to lower the pH (increase the acidity) of water flowing through them, consequently, postmining runoff would probably be less acid than at present (Carter et al. 1978). Additionally, nutrients that are available as a result of organic matter decay within wetland areas would be reduced. However, it is unlikely that altered nutrient flow would significantly affect ecosystem functions within the region.

Wetland-related recreation activity within the project area is minimal and no significant impact to recreation opportunity as a result of construction, operation, and reclamation would be anticipated.

5.3.1.5 Wildlife

This section primarily addresses four adverse impacts to major species or groups: 1) direct habitat loss, which is the actual physical destruction of habitat; 2) indirect habitat loss, which is the effective loss of habitat use because of noise, human contact, or other disturbance directly associated with project construction or operation; 3) effects on animal movements; and 4) construction impacts. Impacts were viewed from regional and local standpoints.

Direct habitat loss from construction and operation of the mine itself, the mine service area, overburden stockpile, and associated roads would be approximately 2,051 ha (5,068 ac) during the 34-year life of the project. In the long term, this loss would be largely mitigated or eliminated for most species by reclamation of the entire area to reestablish wildlife habitat at least as useful and productive as the premining environment. In the short term, i.e., up to 25 years, there would be adverse impacts.

Direct habitat loss as a result of construction and operation would be significant for song bird, shorebird, and small mammal species on a local basis only. Approximately eight existing beaver colonies (Fig. 4-4) would be eliminated during the life of the mine. This, and the adverse impacts on other furbearers, would be significant on a local basis only.

For bald eagles, the loss of salmon spawning habitat with its associated eagle feeding activities, could be significant on a local basis, but would not be significant on a regional basis. Direct habitat loss for trumpeter swans, sandhill cranes, and waterfowl would not be significant.

Direct habitat loss would be significant on a local basis, and possibly on a regional basis, for moose because of elimination of approximately half of one rutting concentration area within the northern portion of the mining limit (Fig. 4-3). The factors that encourage repeated use of a specific area for rutting are unknown. Lone Ridge is an important rutting area on a regional basis. Stress from disturbance or displacement could affect breeding success or chronology and could result in reduced natality* and survival. For brown and black bears, the direct habitat loss would be of local significance due to loss of terrestrial habitat and salmon spawning habitat associated with bear feeding activities.

Indirect habitat loss for song bird, shorebird, small mammal, and most smaller furbearer populations, including beaver, could be significant on a local basis. These species, however, would likely adapt (to varying degrees) to the presence of the facilities and associated activities (Univ. Maine 1983). Indirect habitat loss would be insignificant for waterfowl, shorebirds, swans, and cranes since appropriate habitat is lacking. For bald eagles, indirect habitat loss could be significant on a local basis, unless they adapt to mining activities over time.

For moose and black bears, indirect habitat loss initially could be locally significant, but these species would likely adapt to some extent with time to the presence of noise and activities, and the degree of initial disturbance would probably decrease. Brown bears and marten, however, would likely experience significant local indirect habitat loss because of their generally strong aversion to human activity. This loss would not be significant on a regional basis.

Movements of birds and most mammal species with small home ranges adjacent to the mine area would be largely unaffected in a direct way by project activities in the mine area. However, seasonal movements of moose, bears, and some larger furbearers could be delayed or prolonged as animals seek new routes around the mine pit and other facilities. Individuals may eventually find alternate routes, although populations of moose, especially, tend to continue to use historical movement routes despite man-made obstacles such as the Trans-Alaska pipeline system.

Brown bear movements in particular could be affected because of this species' aversion to human activity. While brown bears are most numerous at higher altitudes in the more open habitats west of the mine area, smaller numbers do inhabit the lower forested areas to the south and east. If normal movements through the mine area were to be hindered by behavioral or physical barriers, brown bear numbers might be substantially reduced in the areas south and east of the mine area. This would be a significant adverse local impact and might be regionally significant if regional movements were affected.

Since the mine area would not be fenced, some animals, e.g., moose or bears, would occasionally wander into the area. These animals would usually not be harmed, but would probably need to be herded out by project personnel. In unusual cases, they may be killed.

Construction activities within the mine area would likely have smaller adverse impacts upon all species than would actual mine operations because of the significantly greater noise and activity levels associated with mining operations.

Habitat Evaluation

The results of the terrestrial habitat evaluation study performed for this EIS are summarized in Table 5-3 for the mine and mine service area and presented in detail in Appendix A. Mining activities would disturb significant areas of high quality black bear and brown bear habitat as well as high and medium quality moose spring/summer/fall habitat. No trumpeter swan habitat or suitable sandhill crane habitat would be directly impacted by the mine or mine service area.

The habitat evaluation study also compared the premining and postreclamation habitat values within the 10-year mine permit area based on the detailed revegetation plan presented in the Surface Mine Permit Application. As indicated in Table 5-4, the postreclamation habitat value would be significantly less for black bear and moose (summer/fall/ spring). The

Table 5-3

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES) FROM MINE DEVELOPMENT BY PROJECT COMPONENT

Species		Mine Service Area	10 Year Mine Limit			30 Year Mine Limit
			Pit Area	Stockpile Areas	Roads and Settling Ponds	Pit Area
Sandhill Crane	Suitable	0	0	0	0	0
	X	---	0	0	---	0
	X	---	0	0	---	0
	Unsuitable	22(55)	564(1411)	80(200)	68(169)	2029(5012)
Trumpeter Swan	High	0	0	---	---	0
	Med	0	0	---	---	0
	Low	0	0	---	---	0
	NU[2]	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Black Bear	High	22(55)	564(1411)	80(200)	64(158)	1982(4955)
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	0	11(27)	0	4(10)	23(57)
Brown Bear	High	22(55)	564(1411)	79(198)	64(158)	1982(4955)
	Med	0	0	0	---	0
	Low	0	0	0	---	0
	NU	0	11(27)	1(2ac)	4(10)	23(57)
Moose Spring/Summer/ Fall	High	14(35)	380(950)	47(117)	47(117)	1356(3349)
	Med	8(20)	85(212)	33(83)	21(52)	653(1612)
	Low	0	180(449)	0	0	20(49)
	NU	0	0	0	0	0
Moose Winter	High	0	0	0	0	0
	Med	0	0	0	0	0
	Low	0	0	0	0	0
	NU	22(55)	575(1438)	80(200)	68(169)	2029(5012)
Total		22(55)	575(1438)	80(200)	68(169)	2029(5012)

1 Exact sighting not finalized.

2 Not utilized.

Table 5-4

COMPARISON OF PREMINING AND POSTMINING HABITAT VALUES FOR EVALUATION SPECIES (10 YR MINING AREA ONLY)

Evaluation Species	Habitat Value	Premining Habitat (Hectares [acres])	Postmining* Habitat (Hectares [acres])
Black Bear	High	660 (1639)	0
	Medium	0	660 (1639)
	Low	0	0
Brown Bear	High	660 (1639)	660 (1639)
	Medium	0	0
	Low	0	0
Moose Summer/Fall	High	398 (984)	71 (178)
	Medium	257 (637)	485 (1202)
	Low	0	104 (259)

*Postmining refers to the period after revegetation has been completed and allowed to stabilize but before reinvasion of native species has reached an equilibrium - estimated as 10-100 years after pit closure.

reduced value to black bear would be primarily due to lack of berry-producing shrubs (such as elderberry, high bush cranberry, and blueberry) and succulent herbs (such as fireweed and vetch) as compared to the existing plant communities. Postreclamation summer/fall/spring habitat value for moose would be lower than existing value because some kinds of selected edible broadleafed herbaceous plants (such as aquatic emergent species) would be absent. In addition, the overall diversity would be somewhat lower, edge habitat (where wooded and open habitats meet) would be decreased, and most of the existing ponded areas would be absent.

It should, however, be emphasized that plant communities are dynamic, especially on reclaimed lands, and the communities established during reclamation would undergo a long-term succession as natural plants invade the restored communities. Eventually a more or less stable equilibrium would probably be reached. The exact nature of the postmining plant community and its wildlife habitat value a century or more after restoration cannot be predicted with accuracy, but it is likely that it would approach the premining condition.

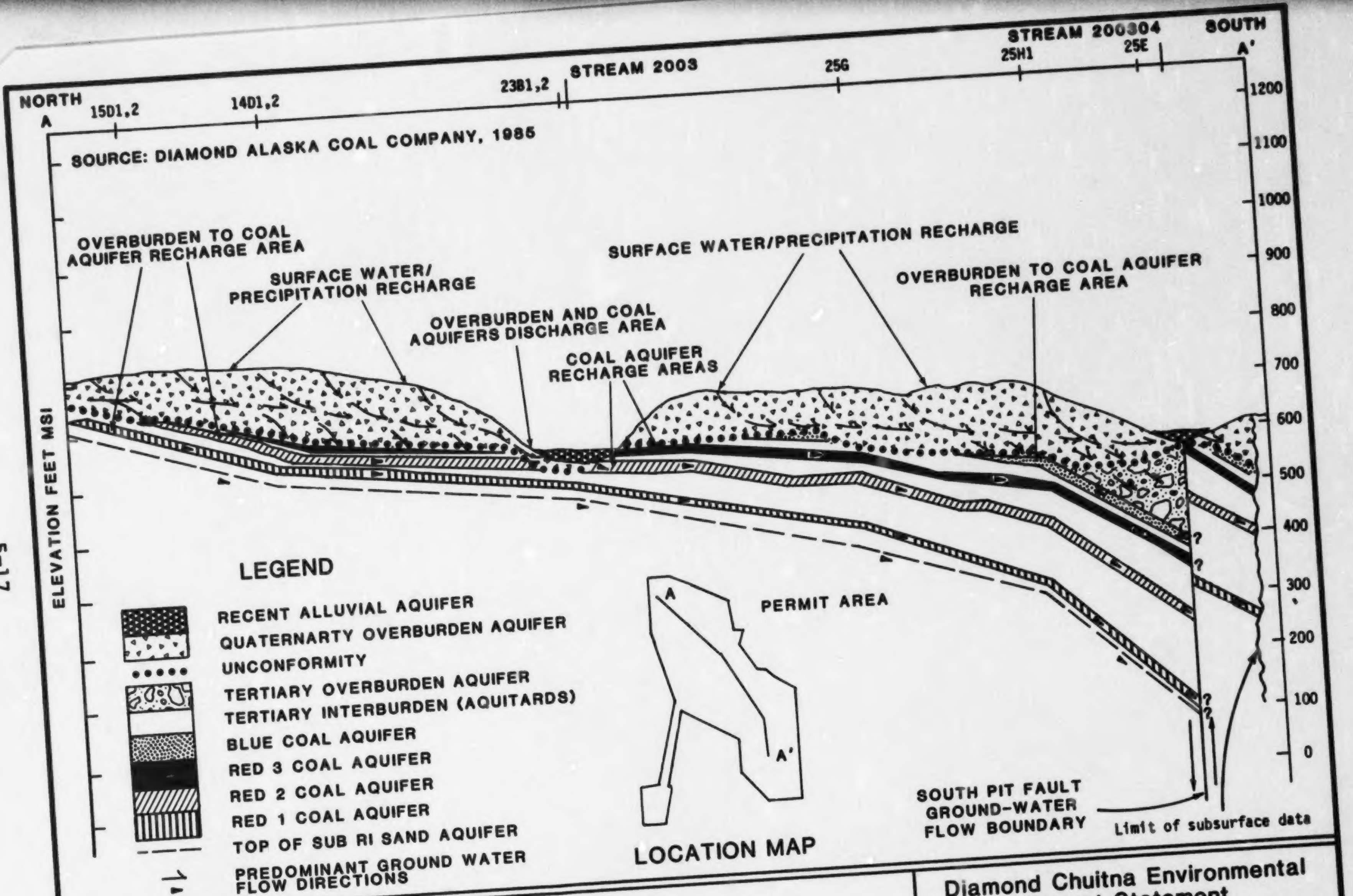
5.3.2 Impacts to Freshwater Environments

5.3.2.1 Ground-water Hydrology and Water Quality

Impacts to the ground-water regime as a result of mining operations would be substantial and would affect recharge and discharge relationships; quantity, quality, and direction of ground-water flows; and quantity and quality of surface water. These impacts are unavoidable; however, with proper planning, the impacts can be minimized.

The overburden materials and coal units that would be removed during mining operations contain large volumes of ground water and can be considered important aquifers in the local hydrological regime (Figure 5-1). The mining operations would disrupt the natural ground-water flow regime within each of the units as they are mined. The intercepted ground-water flow would become inflow to the mine pit area where it would be collected in sumps, pumped to down-gradient offsite sediment treatment ponds, and discharged to streams.

The predicted quantities of ground-water inflow to the pits as mining progresses are summarized on Table 5-5. The intercepted inflow to the pits would, in time, dewater each of the intercepted aquifers. The predicted drawdown values in the active pit after 10 years of operation are 13.7 m (45 ft) and 24.4 m (80 ft) for the overburden and coal zone, respectively. The cone of depression for the overburden aquifer is predicted to extend some 732 m (800 yd) to the


NORTH
A
15D1,2
14D1,2
23B1,2
STREAM 2003
25G
25H1
STREAM 200304
25E
SOUTH
A'
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
ELEVATION FEET MSl
OVERBURDEN TO COAL AQUIFER RECHARGE AREA
SURFACE WATER/ PRECIPITATION RECHARGE
OVERBURDEN AND COAL AQUIFERS DISCHARGE AREA
COAL AQUIFER RECHARGE AREAS
SURFACE WATER/PRECIPITATION RECHARGE
OVERBURDEN TO COAL AQUIFER RECHARGE AREA
?
SOUTH PIT FAULT GROUND-WATER FLOW BOUNDARY
Limit of subsurface data
LEGEND
RECENT ALLUVIAL AQUIFER
QUATERNARTY OVERBURDEN AQUIFER
UNCONFORMITY
TERTIARY OVERBURDEN AQUIFER
TERTIARY INTERBURDEN (AQUITARDS)
BLUE COAL AQUIFER
RED 3 COAL AQUIFER
RED 2 COAL AQUIFER
RED 1 COAL AQUIFER
TOP OF SUB RI SAND AQUIFER
PREDOMINANT GROUND WATER FLOW DIRECTIONS
A
A'
PERMIT AREA
LOCATION MAP

SOURCE: DIAMOND ALASKA COAL COMPANY, 1985

HYDROLOGIC CROSS SECTION A–A'

Diamond Chuitna Environmental Impact Statement

FIGURE 5–1

Table 5-5

ESTIMATED PIT INFLOW RATES[1]

Year of Operation	No Pit Backfill							
	3	4	5	6	7	8	9	10
Inflow to Pits from Overburden Aquifer (l/min[gpm])	484(128)	1,673(442)	1,926(509)	3,531(933)	3,852(1,018)	4,203(1,110)	4,508(1,190)	4,948(1,307)
Inflow to Pits from Coal Aquifer and Sub Red 1 Sand (l/min[gpm])	--	--	195(51)	310(82)	424(112)	516(136)	589(156)	661(175)
Total Inflow (l/min[gpm])	484(128)	1,673(442)	2,123(561)	3,841(1,015)	4,276(1,130)	4,719(1,247)	5,097(1,346)	5,609(1,484)
Total Inflow (l/day[gpd])	698,851 (184,637)	2,410,602 (636,883)	3,052,819 (807,624)	5,523,325 (1,451,197)	6,149,618 (1,626,883)	6,785,712 (1,795,162)	7,329,594 (1,939,046)	8,066,331 (2,133,950)

Year of Operation	With Pit Backfill							
	3	4	5	6	7	8	9	10
Inflow to Pits from Overburden Aquifer (l/min[gpm])	484(128)	1,673(442)	1,926(509)	3,198(845)	2,017(533)	2,540(671)	2,725(720)	1,987(585)
Inflow to Pits from Coal Aquifer and Sub Red 1 Sand (l/min[gpm])	--	--	195(51)	155(41)	159(42)	151(40)	140(37)	136(36)
Total Inflow (l/min[gpm])	484(128)	1,673(442)	2,123(561)	3,354(886)	2,176(575)	2,691(711)	2,865(757)	2,120(560)
Total Inflow (l/day[gpd])	698,851 (184,637)	2,410,602 (636,883)	3,052,819 (807,624)	4,828,835 (1,275,782)	3,130,437 (828,158)	3,870,225 (1,023,869)	4,120,393 (1,090,051)	3,050,150 (806,918)

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[1] ERT 1985b

northwest beyond the mine permit area, while the coal zone cone of depression is expected to extend to the mine permit boundary (Diamond Alaska Coal Company 1985).

Predicted impacts to the mine permit area as a result of the mining operations include:

- A reduction of flow in springs and streams: With time and continued mining, this impact would increase in magnitude. Impacts of interrupted base flow (ground-water input) to surface drainages would be complex. These significant impacts are discussed for each affected stream in Section 5.3.2.2.

  It is anticipated that mining operations (dewatering and lowering of the water table) would affect the ground-water regime throughout the mine permit area. However, these impacts would probably be limited to that area due to the structural faulting which borders the northwest and south sides of the permit area and due to the presence of Lone Creek to the northeast and east. Lone Creek would provide a constant source of recharge and, thus, would minimize the impact of mine dewatering to the east of Lone Creek.

- Disruption of the natural recharge due to mining operations: Natural recharge to the aquifers is predominantly the result of surface-water infiltration from both incident precipitation and snowmelt. Surface disturbance during mining and construction of support facilities and access roads would affect the potential for natural recharge. Surface-water diversions which channel flow to nearby streams would limit the opportunity for, and quantity of, water available for recharge in the mine area.

- Diversion of pit inflow and surface water in the mine area to nearby sediment treatment ponds: Since the treatment ponds are constructed on glacial deposits, some water would infiltrate, but most would be released as surface flow downstream of the mine area. Increased surface flows, with increased bank storage, could result in increased erosion and channelization; however, the storage capacity of treatment ponds would tend to counteract this effect by moderating extreme flows.

- High risk of ground-water degradation from fuel or chemical spills within the mine areas: Proper spill control and prevention plans, and immediate response to spills would limit the magnitude of the impact.

- Potential change in stream temperatures and icing conditions: Discharges of ground water from the sediment ponds into the lower reaches of impacted natural stream systems during the winter, as well as a reduction of ground-water recharge to upper reaches of impacted natural streams, potentially can alter the thermal regime of these streams. Because of these potential impacts, the mine development may affect the magnitude and temporal variation of stream temperatures, subsequently impacting aufeis development and surface ice formation in streams during the winter. These potential impacts are discussed more fully in section 5.3.2.2.

Reclamation of the mine area would at least partly reverse the ground-water impacts from mining. After removal of the surface-water diversion systems, surface water together with incident precipitation would recharge the underlying spoil materials and with time result in the reestablishment of a ground-water regime similar but not identical to the premining condition. It is anticipated that the water quality might be somewhat poorer than the premining quality due to the nature of the spoil material, i.e., intermixed clay, sand, and gravel. That is, the ground water would likely shift from calcium bicarbonate type to calcium and sodium sulfate type associated with an increase in total dissolved solids. However, the premining condition of progressively lower water quality with depth could persist in the reclaimed spoil aquifer. Postmining aquifer properties would also vary from premining conditions; however, this impact would not be expected to adversely affect the regeneration of the postmining hydrogeologic regime since the subsurface materials would probably be permeable and have some capacity for storage and transmission of ground water. The reestablishment of the ground-water regime and, in turn, reestablishment of the surface streams would likely require decades. This is governed by the necessary condition of establishing a quasi-equilibrium between the ground-water and surface-water regimes. If an equilibrium condition similar to the existing condition cannot be established, then maintenance of the baseflow contribution to streams during low flow periods might not be achievable. The elevation of the shallow aquifer water table relative to postreclamation ground surface elevations cannot be predicted with sufficient accuracy to assure base flow contribution to restored stream channels.

5.3.2.2 Surface Water Hydrology

The mine and mine facilities would occupy an area of approximately 2,051 ha (5,068 ac) including the mine pit, drainage and sediment control structures, structures for coal transportation and handling, buildings, and access roads. This area is comprised of portions of the watersheds of Lone Creek and unnamed tributaries of the Chuitna River (streams 2003 and 2004). The areal extents of the watersheds of these streams and the portions occupied by the mine and mine facilities are shown in Table 5-6.

During mine development, no surface runoff from the disturbed areas would enter any stream without passing through a sediment control structure. The stream course of Lone Creek is outside the mine limit and would not be disturbed. Surface runoff from disturbed areas along the western edge of the mine limit would be routed through sediment ponds, treated if necessary, and discharged to stream 2004. Surface runoff from the areas east of the mine pit would be routed through a system of ditches and sediment ponds and discharged to Stream 2003 and Lone Creek. The overall impacts on the downstream hydrology of these streams include moderation of flood peaks and reduction in the annual runoff contributed by the disturbed areas due to storage and evaporation in the sediment ponds.

Surface runoff from compacted gravel areas such as roads and staging areas within the mine limit would be increased to 3 or 4 times the premining conditions during the operation phase. However, these areas would be very small compared to the watersheds of the streams listed in Table 5-6. Water recovered by pit dewatering and surface runoff from the remaining areas within the mine limit would be passed through a system of sediment ponds and ditches before being discharged into streams 2003, 2004, or Lone Creek. Since precipitation (122 cm [48 in]) greatly exceeds evapotranspiration (23 cm [9 in]) in the project area, nearly all surface runoff held in the sediment ponds would eventually be discharged into the streams. Therefore, the net impact to the combined annual runoff of these streams from increased evaporation would be insignificant. The runoff peaks at the downstream boundary of the mine area would be somewhat moderated by the increased pond storage. This beneficial impact would, however, diminish as the mouth of the stream is approached and would eventually become insignificant. Impact on the Chuitna River from the above effects would not be significant.

Table 5-6

WATERSHEDS OCCUPIED BY THE MINE AND MINE FACILITIES

Stream	Drainage Area At Downstream Boundary of Mine Area	Drainage Area At Mouth	Drainage Area within Mine Limit	Drainage Area within Mine Limit as a Percent of Watershed at Boundary of Mine Area	Drainage Area within Mine Limit as a Percent of Watershed at Mouth
1. Unnamed tributary of Chuitna River Stream 2003	16.86 km^2 ($6.51 mi^2$) (Station C140)	39.80 km^2 ($15.37 mi^2$) (Station C180)	14.89 km^2 ($5.75 mi^2$)	88.3%	37.4%
2. Unnamed tributary of Chuitna River Stream 2004	24.39 km^2 ($9.42 mi^2$) (Station C080)	46.98 km^2 ($17.79 mi^2$) (Station C110)	5.18 km^2 ($2.0 mi^2$)	21.2%	11.2%
3. Lone Creek (Stream 2002)	18.52 km^2 ($7.15 mi^2$) (Station C200)	49.78 km^2 ($19.22 mi^2$) (Station C220)	2.59 km^2 ($1.0 mi^2$)	14.0%	5.2%

Diamond Alaska has stated that they do not expect stream temperatures to be significantly impacted by their operation (ASMCRA Application Vol. XVII, pp. 4-261 -4-261h); however, their analysis techniques (simple thermal mass balance) cannot predict localized impacts on the stream thermal regime during winter. Ground-water inflow will be managed throughout the year by pumping into the sediment ponds, subsequently being released periodically, depending on mine operation, into stream systems. The impact of these operations during winter may locally upset the thermal balance by changing the timing and location of ground-water contribution to streams.

In stream reaches where ground water is cut off by the mining operations, reduced thermal mass from the inflowing ground water in winter can cause localized increases in surface and channel ice formation, constricting flow from upstream. The potential flow constriction can enhance the formation of aufeis. In reaches that receive discharges from the sediment ponds in winter, unfrozen water may overflow and create aufeis in regions where ice has already formed. It is impossible to predict the extent of these occurrences without complete knowledge of sediment pond operation in winter, predicted locations of discharges, and stream reaches likely to be impacted by loss of ground water. In addition, the thermal regime in the streams will be highly site specific and are subject to normal year to year variation. The impact of enhanced aufeis development is difficult to ascertain and is expected to be minimal because interruption in ground-water flow to streams is expected to be minimal (ASMCRA Application Vol. XVII, section 4.12.1.3, page 4-205). However, one possible impact is channel morphology changes in localized areas.

One of the most significant physical impacts that would result from development of the Diamond Chuitna project would be alteration of the hydrology of the Chuitna River tributaries in the immediate mine vicinity (streams 2003, 2004, and Lone Creek). In general, the proposed mining plan calls for mining to progress from the northeastern corner of the property in the area of Lone Creek to the south and southwest. The mining will with time progress through a substantial portion of Stream 2003 and into several minor left bank tributaries to Stream 2004.

Because of important implications to fish resources, the chronology of changes that would occur within each of these streams is described in the following paragraphs. Emphasis is on potential alteration of minimum flows because such flows are most often limiting to fish. Aspects of ground-water and surface-water hydrology are integrated to provide an overall view of impacts. In the absence of detailed information regarding the progression of the mine pit and pit backfilling, schedule of transferring treated pit water to the adjacent streams, and hydrologic characteristics of the backfill material, it is not possible to accurately estimate the net reductions in the flows of affected streams. Assuming the watershed areas intercepted by mine related activities after 30 years of mining to be those shown in Table 5-6, rough estimates of the reduced streamflows after 10 years and 30 years of mining have been made (Table 5-7). These estimates assume that there will be no transfer of treated pit water back into the streams and, consequently, represent a worst case situation. Diamond Alaska does plan to pump pit water back into streams. Minimum flows reflect primarily base flow contributions.

The methodology used to generate the figures in Table 5-7 is described below. The premining estimated monthly minimum streamflows shown in Table 5-7 are taken from ERT (1984e). The percentage reductions used to estimate minimum monthly flows after 10 years of mining are the same as those estimated by ERT for monthly average flows of streams at selected stations (Diamond Alaska Coal Company 1985). Generally, the reductions in monthly streamflows after 10 years have been evaluated by a nearly uniform distribution of the total estimated annual reduction in 12 monthly increments with minor adjustments made by judgment. The same heuristic* methodology has been used to estimate the reduced streamflows after 30 years of mining. The ratio of the reduction in annual streamflows to the total flows is assumed to be the same as the ratio of the drainage area occupied by mine-related facilities to the total drainage area of the stream at a particular station. The resulting annual reduction is divided nearly equally in 12 monthly increments.

Since the measured monthly minimum streamflows shown in Table 5-7 are not based on any mathematical ratio, the measured streamflow per square mile of drainage area for each stream is different. Therefore, the above method resulted in some anomaly in that the sum of the estimated eeductions in streamflows for the tributaries of the Chuitna River are less than the estimated reduction in the streamflows of the Chuitna River itself. To avoid the unrealistic situation of 0 winter flow, it was assumed in the case of Stream 2004 that the reductions in the monthly flows, rather than the annual flows, are in the ratios of the drainage areas occupied by the mine to the total drainage areas of the streams. In view of the assumptions stated previously, the values given in Table 5-7 should be treated as order-of-magnitude estimates to be used for qualitative assessment of potential mine-related impacts rather than quantitative indices based on measured or simulated data.

Table 5-7

ESTIMATED MONTHLY MINIMUM STREAMFLOWS

Stream	Drainage Area km2 (mi 2)	Estimated Minimum Flow m3/sec (cfs)											
		August	September	October	November	December	January	February	March	April	May	June	July
1) Lone Creek east of mine area, Station C200, Stream 2002	18.52 km2 (7.15 mi2)												
(a) Premining[1]		0.1 (3.48)	0.30 (10.64)	0.38 (13.43)	0.22 (7.85)	0.20 (7.31)	0.15 (5.18)	0.14 (5.16)	0.13 (4.62)	0.13 (4.68)	0.88 (31.60)	0.29 (10.47)	0.16 (5.56)
(b) After 10 years of mining[2]		0.09 (3.35)	0.29 (10.53)	0.37 (13.30)	0.22 (7.73)	0.20 (7.09)	0.14 (4.94)	0.14 (4.92)	0.12 (4.41)	0.13 (4.52)	0.88 (31.36)	0.29 (10.30)	0.15 (5.48)
(c) After 30 years of mining[2]		0.06 (2.20)	0.26 (9.36)	0.34 (12.15)	0.19 (6.57)	0.17 (6.03)	0.11 (3.90)	0.11 (3.88)	0.09 (3.34)	0.09 (3.40)	0.85 (30.32)	0.26 (9.19)	0.12 (4.28)
2) Lone Creek above confluence with Chuitna River, Station C220, Stream 2002	49.78 km2 (19.22 mi2)												
(a) Premining		0.26 (9.17)	0.69 (24.77)	0.71 (25.47)	0.48 (17.17)	0.46 (16.57)	0.38 (13.58)	0.32 (11.39)	0.26 (9.19)	0.27 (9.82)	1.60 (56.68)	0.40 (14.31)	0.22 (7.84)
(b) After 10 years of mining		0.25 (9.03)	0.69 (24.65)	0.70 (25.32)	0.48 (17.05)	0.46 (16.34)	0.37 (13.41)	0.31 (11.18)	0.25 (9.01)	0.27 (9.70)	1.60 (56.44)	0.39 (14.16)	0.22 (7.75)
(c) After 30 years of mining		0.23 (8.23)	0.67 (23.83)	0.69 (24.53)	0.46 (16.23)	0.44 (15.63)	0.36 (12.64)	0.30 (10.45)	0.23 (8.25)	0.25 (8.88)	1.58 (55.74)	0.38 (13.37)	0.20 (6.90)
3) Unnamed tributory of Chuitna River, Stream 2003, just downstream of mine area, Station C140	16.86 km2 (6.51 mi2)												
(a) Premining		0.05 (1.92)	0.22 (7.92)	0.22 (7.82)	0.11 (3.80)	0.06 (2.29)	0.08 (2.72)	0.06 (2.10)	0.05 (1.98)	0.07 (2.39)	0.34 (12.06)	0.08 (3.02)	0.04 (1.55)
(b) After 10 years of mining		0.05 (1.81)	0.21 (7.70)	0.21 (7.61)	0.10 (3.68)	0.05 (2.02)	0.07 (2.36)	0.05 (1.82)	0.05 (1.72)	0.06 (2.29)	0.33 (11.80)	0.08 (2.80)	0.04 (1.44)
(c) After 30 years of mining		0 (0)	0.12 (4.27)	0.12 (4.17)	0.004 (0.15)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.24 (8.41)	0 (0)	0 (0)
4) Unnamed tributory of Chuitna River, Stream 2003 at mouth, Station C180	39.81 km2 (15.37 mi2)												
(a) Premining		0.13 (4.66)	0.49 (17.50)	0.52 (18.42)	0.28 (10.02)	0.23 (8.25)	0.17 (6.11)	0.14 (4.94)	0.13 (4.75)	0.14 (5.08)	0.66 (23.43)	0.19 (6.98)	0.12 (4.33)
(b) After 10 years of mining		0.12 (4.54)	0.48 (17.27)	0.51 (18.21)	0.27 (9.87)	0.22 (7.92)	0.16 (5.77)	0.13 (4.68)	0.12 (4.28)	0.14 (4.98)	0.65 (23.12)	0.19 (6.76)	0.12 (4.21)
(c) After 30 years of mining		0.03 (1.09)	0.39 (13.93)	0.42 (14.85)	0.18 (6.45)	0.13 (4.68)	0.07 (2.54)	0.04 (1.37)	0.03 (1.18)	0.04 (1.51)	0.56 (19.86)	0.10 (3.41)	0.02 (0.76)

Table 5-7
ESTIMATED MONTHLY MINIMUM STREAMFLOWS
(cont'd)

Stream	Drainage Area km2 (mi 2)	Estimated Minimum Flow m³/sec (cfs)											
		August	September	October	November	December	January	February	March	April	May	June	July
5) Chuitna River downstream of affected area, Station C230	342.48 km2 (132.23 mi2)												
(a) Premining		1.68 (60.17)	5.98 (213.30)	6.82 (243.72)	3.51 (125.52)	3.08 (110.14)	2.88 (102.92)	2.22 (79.27)	1.66 (59.36)	1.88 (67.30)	15.64 (558.61)	4.87 (174.04)	1.56 (55.76)
(b) After 10 years of mining		1.68 (59.97)	5.96 (212.89)	6.81 (243.26)	3.51 (125.28)	3.07 (109.56)	2.86 (102.34)	2.21 (78.76)	1.65 (58.96)	1.87 (66.87)	15.62 (557.88)	4.87 (173.85)	1.56 (55.60)
(c) After 30 years of mining		1.41 (49.97)	5.74 (203.10)	6.61 (233.52)	3.26 (115.32)	2.83 (99.94)	2.62 (92.72)	1.95 (69.07)	1.39 (49.16)	1.62 (57.10)	15.52 (548.41)	4.64 (163.84)	1.29 (45.56)
6) Unnamed Tributary of Chuitna River, Stream 2004, Station C110, at Mouth	17.79												
(a) Premining		1.95 (68.9)	4.89 (172.8)	5.01 (177.0)	3.18 (112.4)	1.22 (43.1)	0.74 (26.1)	0.61 (21.6)	0.24 (8.5)	3.91 (138.2)	8.55 (302.1)	2.81 (99.3)	2.32 (82.0)
(b) After 10 years of mining				NO SIGNIFICANT IMPACT									
(c) After 30 years of mining		1.73 (61.1)	4.34 (153.4)	4.45 (157.2)	2.82 (99.6)	1.08 (38.2)	0.66 (23.3)	0.54 (19.1)	0.21 (7.4)	3.47 (122.6)	7.59 (268.2)	2.49 (88.0)	2.06 (72.8)
7) Unnamed Tributary of Chuitna River, Stream 2004, Station C080, About one mile upstream of mouth	9.42												
(a) Premining		1.03 (36.4)	2.59 (91.5)	2.65 (93.64)	1.68 (59.36)	0.65 (22.97)	0.39 (13.78)	0.32 (11.31)	0.13 (4.59)	2.07 (73.14)	4.53 (160.07)	1.49 (52.65)	1.23 (43.46)
(b) After 10 years of mining				NO SIGNIFICANT IMPACT									
(c) After 30 years of mining		0.81 (28.6)	2.04 (72.08)	2.09 (73.85)	1.32 (46.64)	0.51 (18.02)	0.31 (10.95)	0.25 (8.13)	0.10 (3.53)	1.63 (57.60)	3.57 (126.15)	1.17 (41.34)	0.97 (34.28)

Source: 1. ERT 1984a, 1985c
2. Dames & Moore calculations

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[1] Assumes no pumping of pit water back into streams; thus, these numbers represents a worst case scenario. Diamond Alaska, however, does plan to pump pit water into streams.

[2] Model used for these calculations required the use of assumptions since no actual field data is available. Therefore, these numbers must be treated as "order-of-magnitude estimates to be used for qualitative assessment" of potential impacts.

Lone Creek

The initial box cut will approximately parallel Lone Creek, but will not directly impact the stream course. Both surface runoff and the base flow contribution from that portion of the Lone Creek watershed within the affected mining area, however, will be directly impacted. The impacts to Lone Creek are expected to be greatest during low flow periods, particularly during late summer and winter, when the stream flow is comprised entirely of base flow (ground-water input). The resultant decrease in base flow contribution is estimated on the basis of maximum drainage area affected to be about 25 percent assuming no pumping from the pit.

Another calculation method using a percent of the predicted pit inflow combined with a Glover depletion analysis (Diamond Alaska Coal Company 1985) estimated that base flow in Lone Creek would be reduced by 8.5 percent after year 10 at a stream station immediately below the mining activity. It is likely that actual maximum depletion would occur after year 10 and would be in the range of 8.5 to 25 percent. The maximum impact would be reached in the middle years of mining and would continue over the mine life. Some alleviation of impact could occur late in the mine life if ground-water recharge occurred in the backfill adjacent to Lone Creek and reached sufficient elevation so that it could begin to contribute again to base flow. However, the pit bottom, being the lowest point, would still be the principal point of collection for water within the mined out area and base flow contribution to Lone Creek from the mine area would not be fully restored until 5 to 10 years after backfilling is completed and recharge has occurred.

As indicated in Table 5-7, minimum flows could be reduced during low flow periods (late summer and late winter) by up to 25 percent within the portion of Lone Creek east of the mine. As flows increase downstream, impact would be proportionally less. The above calculations of flow reduction assume no transfer of pit drainage to Lone Creek. During the first 10 years of mining, Diamond Alaska plans to release much of its pit drainage into Lone Creek; therefore, net flow could actually increase at least temporarily. The up to 25 percent reduction would still occur in the event of pump failure or in the event that pit water freezes and cannot be pumped. Water allocation during later years of mining has not been planned but it is reasonable to assume that as the pit progesses westward, discharge from dewatering would be more likely to be released in the Stream 2003 or 2004 watersheds than into Lone Creek.

Stream 2003

Greatest impact would occur to Stream 2003 since a substantial portion of the stream and its watershed would be within the mine area. Mining would proceed in a southwesterly direction starting at the extreme headwaters of Stream 2003 and moving downstream. Thus, impact would be cumulative over the 30-year mine life with maximum impact occurring when the mine reached its maximum extent. At 30 years, about 14,200 m (46,570 ft) of stream channel would be removed along with 14.9 km^2 (5.75 mi^2) of watershed area.

As mining progressed to the southwest, the impact on Stream 2003 would continue to increase. The impact on base flow contribution to 2003 would be most pronounced during low flow periods (Table 5-7). The magnitude of the effect of base flow contribution to the stream would depend on its proximity to the active mining area. In this regard, the pit bottom, being the lowest point would be the principal point of collection for water within the mined-out areas. It would also be the "low point" with respect to existing terrain and, therefore, would induce drainage of surrounding areas. Plans provide for the accumulated surface and ground waters to be routed through a series of sedimentation/treatment ponds prior to their discharge to existing streams. In the worst case (e.g., during cold winter weather), it is projected that during at least short periods of time, there would be no direct discharge from the mine to Stream 2003 downstream of the mining area. This implies, therefore, the total streamflow in Stream 2003 may be lost for at least some distance downstream of the mine limit. The downstream point at which ground-water discharge or base flow would be sufficient to sustain streamflow throughout the year is not known, but believed to be in the range of 0.8 to 2.4 km (0.5 to 1.5 m) downstream from the 30-year mine limit because of the confluence of tributaries 200303 and 200302, both of which would be relatively unaffected by mining. Minimum flow at the mouth of Stream 2003 could be reduced by as much as 80 percent during low flow period (Table 5-7).

After cessation of mining, the backfilled and reclaimed areas would begin to resaturate by infiltration and the ground-water levels in the vicinity would tend to recover to near premining conditions. Depending upon the hydraulic conductivity and porosity of the backfill material, it may take 5 to 10 years for the restoration of ground-water levels to the premining conditions. Therefore, the impacts on streamflows shown in Table 5-7 would be expected to continue through this recovery period. As a consequence of pit excavation and mine dewatering, existing bogs and wetlands within the mine area would be eliminated. This would result in the loss of the shallow ground-water system within the organic layer that currently provides much of the input to Stream 2003. Thus, even after reclamation, the postmining monthly minimum streamflows of the affected streams would be expected to be somewhat lower than the premining values shown in Table 5-7.

The main channel of Stream 2003 will not be disturbed during the 10 year mine period; however, tributaries 200304 and 200305 will be mined through or used to form sedimentation ponds. During the 30 year mine period, approximately the upper one-third to one-half of 2003 including tributaries 200304, 200305, and 200306 will be mined through (Figure 4-5). It is the applicant's intent to restore permanent stable channels along the approximate original courses of these streams after reclamation using established engineering techniques. However, the backfill material on which the restoration channels would be formed cannot be compacted to the same degree as the original bed material of these streams and would be susceptible to some erosion and degradation until geomorphologic equilibrium were attained. Remedial stabilization measures would probably be required during the early years of restoration. Furthermore, there would be no guarantee that the post-reclamation water table would coincide with the elevations of the recreated stream channels. Therefore, while it would be possible to reconstruct stream channels having physical characteristics similar to the existing stream channels, there is no way to predict whether the new channels would have sufficient base flow through the upper reaches to provide year-round flow similar to that which now exists.

Stream 2004

Toward the end of the 30-year mine period, several minor left bank tributaries of Stream 2004 would be mined out. The impacts of mining through these tributaries would be similar to those described for Lone Creek. These impacts would include a reduction in both surface flow and the base flow contribution to the stream. Based on drainage area considerations and the topographic relief to west of the stream course, the percentage reduction in flow is estimated to be about 21 percent of the normal flow at the time of maximum mine extent.

Possible alterations to minimum flows as a result of mining are presented in Table 5-7. Impacts to Stream 2004 would be of shorter duration than for the other mine area streams since the stream would not be affected until late in the mine life. After backfilling and ground-water recharge, base flows would be restored and long-term impact would probably be insignificant.

Chuitna River

As indicated in Table 5-7, minimum flow in the Chuitna River immediately below the mouth of Lone Creek could be reduced by up to 17 percent during low flow periods in the later years of mining. This reduction would represent an extreme worst case situation and would be unlikely during mining because of the addition of return water to the Chuitna drainage from the various mine area drainage systems. If the mine dewatering system should fail during low flow months (e.g., August, March) in the later years of mining, then a temporary flow reduction in the 10 to 20 percent range could occur. In the lower reaches of the Chuitna River where flow is greater, the impact of such a flow reduction would be proportionally reduced. Flow in the Chuitna River would also be reduced during the period following mine closure while ground-water recharge is occurring in the backfilled area. Initial reduction after mine closure could be in the 10 to 20 percent range and would gradually decrease to near 0 over a period of up to 10 years until recharge is completed. Hydrological characteristics of the Chuitna River after reclamation and recharge would not be significantly different from the existing condition.

5.3.2.3 Surface Water Quality

General Criteria

Surface water quality would be controlled by both EPA and state regulations. These regulations are based upon protection of existing and potential beneficial uses of the water as well as national water quality objectives. The most stringent requirements would be applicable. Domestic wastewater would, as a minimum, require secondary treatment. Most other water discharges from the project would be treated in upgraded sediment pond treatment systems prior to discharge. EPA criteria would require sediment pond discharge to meet the following minimum requirements (EPA 1982):

- pH in the range of 6 to 9
- During rainfall events (less than 10-year events occuring in 24 hours) that result in an increase in base streamflow or when snow or ice exist and ambient air temperature is above freezing (thaw conditions) settleable solids must be less than 0.5 ml/l
- During non-thaw or non-storm periods: 30-day average of 35 mg/l and 3.0 mg/l suspended solids and total iron respectively; maximum day value of 70 mg/l and 6 mg/l suspended solids and total iron respectively

- During 10-year, 24-hour or greater storm events, only the pH level requirement of 6 to 9 is applicable
- Discharges from outfalls 017 and 018 shall not exceed a daily average of 10.0 mg/l or a daily maximum of 15.0 mg/l for oil and grease during baseflow conditions.

In addition to the EPA pH, iron, and sediment standards, state standards would apply to protect the current and possible beneficial uses of the water.

In Alaska, the water quality standards are the responsibility of the ADEC. Except in a few special cases, fresh and marine surface waters in Alaska must meet all standards designed to protect water quality for the uses shown below. The exceptions are noted in the 1987 water quality standards (ADEC 1987) which indicate that all water bodies in Alaska are classified for all uses except the lower Chena River and Nolan Creek and all its tributaries excluding Acme Creek which are classified for industrial use.

Freshwater Uses

- Drinking, including cooking and food processing
- Agriculture (irrigation and stock watering)
- Aquaculture
- Industry (mining, pulp milling, etc.)
- Contact recreation (swimming, wading, bathing, etc.)
- Secondary recreation (boating, hiking, camping, etc.)
- Growth and propagation of fish, shellfish, and other aquatic life

Saltwater Uses

- Seafood processing
- Harvesting of clams or other aquatic life
- Aquaculture
- Industry (other than seafood processing)
- Contact recreation (swimming, wading, bathing, etc.)
- Secondary recreation (boating, hiking, camping, etc.)
- Growth and propagation of fish, shellfish, and other aquatic life

Associated with each use are criteria for different water quality parameters. For example, drinking water quality criteria specify limits on bacterial contamination, color, temperature, turbidity, and sediment, as well as other parameters. The water quality standards consist of the set of most stringent criteria associated with each water use. Generally, the ADEC receiving water standards would require (ADNR 1984):

- Turbidity
  - 5 NTU above natural background when background is below 50 NTU
  - 10% increase when background is above 50 NTU
  - 25 NTU maximum increase

- TSS/Suspended solids
  - No increase above background, can have a mixing zone

- Metals and other parameters
  - Drinking water criteria or aquatic life standards if a specific hazard to aquatic life has been identified.

The specific parameter limitations typically are modified to reflect background levels if a receiving water has normally elevated concentrations of specific parameters. The receiving water standards are based upon impacts to human and aquatic life and are therefore being used as standards for this impact analysis.

Mine and Mine Area Facilities

- Mine Site Runoff

Mine site runoff consists of surface water other than pit drainage that flows from the project area into area streams. During operation, the mining process would result in progressive disturbance and reclamation of a fixed size area. Before excavation begins in an area, surface drainages would be rerouted. Areas that had been mined would be reclaimed with interburden and overburden replaced in the same relative positions and in the same relative topographic configuration. Revegetation, routing drainage through ditches, and erosion control measures would be undertaken immediately upon redeposition of the material in the mined area (ERT 1985c).

Erosion control measures would consist of permanently developed site drainage courses, contour reclamation, mulching, temporary drainage control, revegetation, and construction of long-term sediment ponds. Eighteen sediment pond systems are planned for the mine and mine area facility. Drainage slopes and most side slopes would generally be limited to 5 percent to limit runoff velocities, although some areas would have slopes up to 12 percent. On steep slopes, alternative sediment control measures include filter dams, sediment filter fabric installations, gravel pads, chemical mulches, and matting as necessary (Diamond Alaska Coal Company 1985, Vol. XXI). Sediment ponds would be utilized until well after the entire reclaimed drainage is stabilized and runoff naturally meets background quality (ERT 1985c).

During sediment pond construction, temporary sediment control measures would be employed to limit impacts to streams. These measures could include filter fabric sediment fences, specific construction scheduling, immediate matting and revegetation or other approved techniques.

The erosion precautions noted would be designed to control major suspended solids discharges (ERT 1985c). However, test data illustrates that without further treatment, sediment discharges and corresponding turbidities would exceed proposed standards under various conditions (Diamond Alaska Coal Company 1985, Vol. XXI). Without flocculation treatment in the sediment pond systems, effluent turbidities could range from 30 to more than 14,000 NTU* during major flow events (10-year/24-hour). The high range turbidity would be in excess of allowable discharge limitations. Therefore, additional treatment using polymer flocculation to increase settling effectiveness is necessary to provide compliance.

Recent laboratory bench scale and modeling tests have indicated that with a polymer flocculation-sedimentation system, effluent turbidities may be reduced to between 5 and 37 NTU during major flow (10-year/24-hour) events (Diamond Alaska Coal Company 1985, Vol. XXI). Based upon turbidity and suspended solids correlations, Diamond and the state have estimated turbidities in receiving waters at various flood flows. Turbidity in receiving water is expected to range from 1,500 and 2,000 NTU for a 10-year, 24-hour flood event (Diamond Alaska Coal Company 1985, Vol. XXI). Therefore, all turbidity criteria would likely be met during major storm events. Compliance is further projected for 2-year, 24-hour storm conditions.

During winter baseflow conditions, stream turbidities are very low. Compliance of discharge at low baseflow conditions is not directly projected by the recent studies and modeling (Diamond Alaska Coal Company 1985, Vol. XXI). However, the conservative assumptions used, as well as limitations on discharge rates, proposed double stage flocculation for problem sediment pond systems, and possible use of controlled discharge versus stream baseflow. The applicant projects that compliance will be achieved after application of a mixing zone (ASMCRA Volume XXI, Table 40). However the actual size and amount of dilution will not be known until ADEC acts on applicant's request for mixing zones. Treatment during winter baseflow conditions will be adequate to prevent degrading receiving stream water quality. ASMCRA stipulation 3 describes conditions which must be met by the applicant prior to receiving winter baseflow in the pond systems (7, 11, 13, and 15/16) that will receive winter baseflow. Furthermore, the Water Quality Contingency Plan (stipulation 6), specifies additional treatment measures that will be implemented if sediment pond discharges fail to meet Alaska water quality standards.

No specific testing has been conducted to determine what potential pollutants may leach from disturbed overburden material. However, laboratory leach tests on the coal have not indicated significant amounts of metals, organics, or other potential pollutants (Bookcliffs 1985). Table 5-8 combines information from available baseline measurements to estimate water quality that could be expected from normal sediment pond systems. Since the information for other than total suspended solids is for dissolved material, it is assumed for the worst case analysis that sediment pond settling would not reduce metals or similar contaminant levels significantly. A comparison with baseline data in existing site streams illustrates that normal sediment pond discharge may be expected to have slightly higher levels of the elevated parameters in the baseline stream water quality. Treatment to meet state and federal standards would limit increases in total loadings in the receiving water. No pollutants significantly in excess of background levels have been observed in runoff from disturbed site test areas (ERT 1984e). No significant water quality impact is anticipated from disturbed site leaching although some present surface water has slightly elevated levels of boron, iron, nickel, manganese, zinc, and ammonia nitrogen which may continue to be periodically above standards or slightly increase. The projection of a slight increase is based upon baseline data as well as a leaching test performed on coal samples. In addition, an analysis of overburden and coal constituents and corresponding ground-water quality supports a contention that leaching would not be excessive.

As proposed by the applicant, flocculation and sedimentation treatment for excessive suspended solids, turbidity, or metals would most likely involve the use of polymers for solids removal. The flocculants polyethylene oxide (PEO) and Percol 352 have been tested in a two stage laboratory jar test

Table 5-8

ESTIMATED SEDIMENT POND EFFLUENT WATER QUALITY[1] (AFTER SEDIMENTATION AND FLOCCULATION TREATMENT)

Parameter	Projected Sediment Pond Effluent Water Quality (Range)[5]	Receiving Water Quality (Range)[2]	Anticipated Receiving Water Quality Standard[3]
Alkalinity as $CaCO_3$	5.5 - 43	5.5 - 43	20 or more
Aluminum, dissolved (mg/l)	<0.1 - 0.4 (total)	<0.1 - 0.4 (total)	---
Arsenic, dissolved (mg/l)	<.005	nd	0.05
Bicarbonate as $CaCO_3$ (mg/l)	<52	nd	---
Boron, dissolved (mg/l)	<.1 - 0.52	<.1 - 0.1	0.043*+
Cadmium, dissolved (mg/l)	<.005	nd	0.004
Calcium, dissolved (mg/l)	1.4 - 10	1.4 - 9.3	---
Carbonate as $CaCO_3$ (mg/l)	0	nd	---
Chloride (mg/l)	0.06 - 13	0.06 - 4.4	200
Chromium, dissolved (mg/l)	<.02	nd	0.05
Conductivity (umhos/cm @ 25°C)	11 - 300	11 - 121	---
Copper, dissolved (mg/l)	<0.02 - 0.12 (total)	<0.02 - 0.09 (total)	1.0
Fluoride (mg/l)	0.01 - 0.3	0.01 - 0.09	2.4
Hardness as $CaCO_3$ (mg/l)	<45	nd	---
Iron, dissolved (mg/l)	0.2 - 3.4 (total)	0.2 - 3.4 (total)	0.3*+
Lead, dissolved (mg/l)	<0.02 - 0.03	<0.02 - 0.03	0.03*
Magnesium, dissolved (mg/l)	0.1 - 4.4	0.1 - 2.5	---
Manganese, dissolved (mg/l)	<0.02 - 0.2	<0.02 - 0.2	0.05*
Mercury, dissolved (mg/l)	<0.001 - 0.001 (total)	<0.001 - 0.001 (total)	0.0002
Molybdenum, dissolved (mg/l)	<.02	nd	0.07
Nickel, dissolved (mg/l)	<0.02 - 0.05 (total)	<0.02 - 0.05 (total)	0.025*+
Nitrogen, ammonia (mg/l)	<0.01 - 1.5	<0.01 - 1.5	0.020*+
Nitrogen, nitrate/nitrite (mg/l)	<0.05 - 1.5	<0.05 - 1.5	10
Organic carbon, dissolved (mg/l)	<35	nd	---
pH (units)	5.9 - 7.8	5.9 - 7.8	6.5 - 8.5
Potassium, dissolved (mg/l)	0.25 - 3	0.25 - 2.0	---
Selenium, dissolved (mg/l)	nd	nd	0.010
Sodium, dissolved (mg/l)	0.4 - 35	0.4 - 6.0	250
Solids, dissolved (mg/l)	2 - 200	2 - 104	500*6
Sulfate (mg/l)	0.27 - 20	0.27 - 4.5	200
Suspended Solids (mg/l)	5 - 20[4]	<1 - 60	35 mg/l+
Zinc, dissolved mg/l)	<0.02 - .08	<0.02 - 0.04	0.030*+

nd = no data

*Parameters with potential to equal or exceed receiving water standards before dilution in a mixing zone.
+The receiving water at times equals or exceeds some of these standards now under natural conditions.

NOTES:

[1] Water quality estimates are based upon an analysis of baseline data. No actual sediment pond related tests were performed. This estimate of quality is not statistically significant and represents possible ranges only.

[2] Range from an analysis of surface water quality. Does not include peak discharge quality measurements (ERT 1985a).

[3] Standard listed is the most stringent for the various protected uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984.

[4] From Diamond Alaska Coal Company 1985, Vol. XXI. Note - low flow conditions critical and require additional operational modifications for compliance with turbidity regulations.

[5] Range from an analysis of surface runoff quality (ERT 1985a) and leach data (Bookcliffs 1985).

[6] The standard for total dissolved solids is 500 mg/l or no greater than 1/3 higher than natural condition, whichever is less.

procedure. Sediment removals were good, resulting in low turbidity levels. Furthermore, the ASMCRA, through stipulation 1, requires the applicant to install all necessary equipment on sediment pond systems 1-6, 8-12, 15, and 16 prior to the ponds going into operation. Stipulation 6 discusses additional treatment measures that may be implemented to insure that sediment pond discharges meet Alaska water quality standards. If required, aluminum sulfate (alum), ferric chloride, or lime could be employed for metals precipitation. Polymers are listed as "relatively non-toxic" while lime addition would result in increased pH, higher dissolved solids, and increased calcium concentrations (Hawley 1977). Toxicity of lime would normally be pH dependent. The discharge could not be allowed to be elevated to pH levels causing aquatic impacts. Low levels of alum have not been found to be toxic (Hawley 1977).

Impacts from site runoff are not anticipated to be significant with proposed treatment. With present sediment pond design and planned polymer flocculation, tests have indicated that treated pit water discharges which would occur during dry periods when high runoff exemptions are not applicable may be the worst case condition but are not projected to exceed the limits for total suspended solids with special operational limits. Refer to Section 5.4.2.3 for an analysis of potential impacts to fish and other aquatic plants and animals.

Erosion control for overburden stockpiles would be accomplished as described for the mine area. Water quality impacts from these areas are not anticipated to be different from other disturbed sites.

- Pit Drainage

The actual mine workings or pit would accumulate water from surface runoff and from ground-water seepage into the pit. This water would not drain or infiltrate from the deep pit, but would be collected in the bottom sump of the pit where settling would substantially reduce sediment loads. Initial estimates by the applicant indicate up to 70 percent removal of solids in the pit settling areas. During periods of high rainfall, the pit drainage water would be high in suspended solids. Runoff and sediment levels would also be high in the receiving streams during these storm events. However, natural stream flow and sediment levels would rapidly decrease after the storm event while sediment-laden water would continue to be pumped from the in-pit sumps for many days or weeks depending on the storm event and pond system. The applicant would only pump from the in-pit sumps when the discharge can meet the Alaska water quality standards. This provision is described in the Water Quality Contingency Plan (stipulation 6 ASMCRA). During low rainfall, most of the pit drainage water would be from ground-water drainage and would reflect the quality of the aquifers intersected and erosion and sediment from excavations.

Table 5-9 illustrates the range of projected conditions for pit water quality. When runoff predominates, sediment levels after treatment may reach in excess of 20 mg/l TSS and parameters such as boron, iron, nickel, manganese, ammonia, nitrogen, and zinc may reach or exceed standards. When ground-water seepage predominates, projected suspended solids levels would be lower. It is significant that background water quality in the receiving waters would at times also likely equal or exceed the standards for boron, iron, nickel, manganese, ammonia, nitrogen, and zinc as shown by the baseline data. Table 5-9 also lists the applicable receiving water standards which discharge from the pit collection sumps must ultimately meet.

Water which would be pumped from the pit would be discharged into site drainage sediment pond systems. This would provide additional settling. Diamond Alaska has committed to a flocculant treatment system to comply with discharge requirements. Lime or a similar flocculant-coagulant would be used for metal removal, if necessary, while a polymer would be used to enhance sediment removal.

The potential for contamination from metals appears to be small according to laboratory leaching tests. Although the Beluga low sulfur coal is non-acid generating, some metals do leach from it in minor quantities (Bookcliffs 1985). If metals treatment or treatment for excessive sediment load became necessary, a precipitating flocculant could be introduced before the sediment ponds. The flocculant would reduce both metals and suspended solids (sediment). Initial operational testing would determine the need for such pretreatment since it is difficult to determine under laboratory conditions.

The impact of the pit drainage would be most significant during low winter stream flows. In the winter, surface runoff would be minimal, while ground-water seepage into the pit would continue at near normal rates. At certain times, most of the streamflow in Stream 2003 could be from treated pit drainages. At other times (depending upon the location of mining activities) major portions of Lone Creek or Stream 2003 flows could be from treated pit drainage. Impacts to water quality would be greatest when nearby pit operations divert baseload ground water from the creeks, leaving the pit return flow as the primary water source. Since pit drainage would

Table-5-9

PIT DRAINAGE EFFLUENT WATER QUALITY PROJECTION (AFTER SEDIMENTATION AND FLOCCULATION TREATMENT)

	Projected In-Pit Water Quality		
Parameter	Rainfall Predominated[1] (Range)	Seepage Predominated[2] (Range)	Anticipated Receiving Water Quality Standard[3]
Alkalinity as $CaCO_3$	5.5 - 43	98 - 270	20 or more
Aluminum, dissolved (mg/l)	<0.1 - 0.4 (total)	<.2	---
Arsenic, dissolved (mg/l)	nd	<0.01	0.05
Bicarbonate as $CaCO_3$ (mg/l)	nd	99 - 233	---
Boron, dissolved (mg/l)	<.1 - 0.1	<0.1 - .52	0.043*
Cadmium, dissolved (mg/l)	nd	<0.01	0.004
Calcium, dissolved (mg/l)	1.4 - 9.3	17 - 58	---
Carbonate as $CaCO_3$ (mg/l)	nd	0 - 24	---
Chloride (mg/l)	0.06 - 4.4	1.6 - 13	200
Chromium, dissolved (mg/l)	nd	<0.02	0.05
Conductivity (umhos/cm @ 25°C)	11 - 121	180 - 906	---
Copper, dissolved (mg/l)	<0.02 - 0.09 (total)	<0.02 - .1	1.0
Fluoride (mg/l)	0.01 - 0.09	<.24	2.4
Hardness as $CaCO_3$ (mg/l)	nd	65 - 134	---
Iron, dissolved (mg/l)	0.2 - 3.4 (total)	0.12 - 0.96	0.3*
Lead, dissolved (mg/l)	<0.02 - 0.03	<0.02	0.03
Magnesium, dissolved (mg/l)	0.1 - 2.5	<5	---
Manganese, dissolved (mg/l)	<0.02 - 0.2	.06 - .29	0.05*
Mercury, dissolved (mg/l)	<0.001 - 0.001 (total)	<.001	0.0002
Molybdenum, dissolved (mg/l)	nd	<.02	0.07
Nickel, dissolved (mg/l)	<0.02 - 0.05 (total)	<.02	0.025*
Nitrogen, ammonia (mg/l)	<0.01 - 1.5	0.5 - 4.1 (as N)	0.020*
Nitrogen, nitrate/nitrite (mg/l)	<0.05 - 1.5	<0.01 - 0.15 (as N)	10
Organic carbon, dissolved (mg/l)	nd	0.17 - 80	---
pH (units)	5.9 - 7.8	7.1 - 8.2	6.5 - 8.5
Potassium, dissolved (mg/l)	0.25 - 2.0	1.9 - 4.8	---
Selenium, dissolved (mg/l)	nd	<0.01	0.010
Sodium, dissolved (mg/l)	0.4 - 6.0	9.1 - 57	250
Solids, dissolved (mg/l)	2 - 104	200±	500*[5]
Sulfate (mg/l)	0.27 - 4.5	2.5 - 40	200
Suspended Solids (mg/l)	5 - 20	<35 mg/l est.	35 mg/l
Zinc, dissolved mg/l)	<0.02 - 0.04	<0.02 - 0.36	0.030*

nd = no data

*Parameters with potential to equal or exceed receiving water standards before dilution in a mixing zone.

NOTES:

[1] Range of surface runoff quality. Does not include peak discharge quality measurments (ERT 1985a).

[2] Ground water data (ERT 1984e) and leach data (Bookcliffs 1985).

[3] Standard listed is the most stringent for the various protected uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984. The receiving water at times equals or exceeds some of these standards now under natural conditions.

[4] From Diamond Alaska Coal Company 1985, Vol. XXI. Note - low flow conditions critical and require additional operational modifications for compliance with turbidity regulations.

[5] The standard for total dissolved solids is 500 mg/l or no greater than 1/3 higher than natural conditions, whichever is less.

be a continuing winter flow, sediment ponds and other treatment processes would be operated to assure unobstructed water flow into and out of the sediment ponds.

Impacts of treated pit drainage to receiving waters would be especially critical since little dilution water would be available in winter. Therefore, in many instances, no real zone of mixing could be defined. During winter baseflow conditions, stream turbidities are very low. Compliance of discharge at low baseflow conditions is not directly projected by the recent studies and modeling (Diamond Alaska Coal Company 1985, Vol. XXI). However, the conservative assumptions used, as well as limitations on discharge rates, proposed double stage flocculation for problem sediment pond systems, and possible use of controlled discharge versus stream baseflow suggests that there is enough flexibility built into the system such that compliance can be achieved.

The specific impacts could be slight increases in normal sediment levels and turbidity and possibly in boron, nickel, iron, manganese, ammonia nitrogen, and zinc concentrations. The proposed treatment methods using flocculants are slightly reduced in efficiency during very cold conditions. Although other treatment methods are not feasible on the scale necessary, use of settling alone to remove suspended solids as well as precipitated metals would limit strict compliance with water quality standards without the proposed operational modifications. Treatment and removal of ammonia nitrogen would not be feasible on such a large scale nor at such low concentrations. The occurrence of metals and ammonia nitrogen in the projected pit drainage flow is based upon baseline data analyses and with present data is not statistically significant as a projection of actual pit drainage quality. In addition, estimated impacts would not be significant compared to baseline conditions.

- Mine Service Area

The mine service area would contain shops, coal transfer points, equipment ready yards, and a small coal storage area. Sources of waste water during operation include site runoff, runoff from coal storage and transfer areas, washdown water from equipment maintenance facilities, and domestic sewage.

Runoff from disturbed areas would be routed through stabilized drainage systems and sediment ponds before being discharged to tributaries of the Chuitna River. Water quality of the coal storage area and coal transfer point runoff could be similar to that of the pit drainage.

No adverse effect on water quality is expected from water use and the disposal of treated sanitary wastes from mine site facilities. Domestic waste will be treated by secondary treatment and discharged into the Chuitna River at the same location as the discharge from the housing complex. The effects of domestic waste discharges on the Chuitna River are discussed in detail in the Housing Facilities section using the total discharge from both treatment plants.

No significant impact would occur from the discharge of treated effluent. However, there may be risks from breaks in the 3.2 km (2 mi) pipeline due to freezing during the winter. This could result in discharge of treated secondary effluent to local drainages. The impact of such a spill would be limited in area and volume and the quality of the effluent would be high. Adverse impacts from such a spill would not be significant.

Wildfires and man-caused fires including slash burning can affect water quality by introducing into water bodies nutrients and suspended solids resulting from erosion in burned areas. Depending on the water body, this may be an adverse or beneficial effect. Fire fighting equipment and techniques also disturb watersheds, causing effects on water quality.

Petroleum product spills into water bodies would adversely affect water quality. A layer of petroleum on the surface of a water body would inhibit aeration of the water, reducing the dissolved oxygen content. Soluble fractions are usually toxic to plant and animal life. The probability of large spills, however, is low because all storage areas would be surrounded by dikes capable of retaining 110 percent of the volume of the petroleum product storage tanks. Additionally, an SPCC plan would be developed to minimize the potential for accidental discharge of refined products and to outline cleanup response if a spill occurred.

Solid wastes generated in the mine area would be landfilled in an approved solid waste disposal site. Permit restrictions would require design of a facility that would protect surface and ground-water quality. Wells would be installed to monitor any adverse effects early so that actions could be taken to correct any water quality impacts.

The solid waste disposal sites would require fencing and periodic covering of deposited wastes to control blowing debris and limit animal problems. Burnables would be incinerated prior to landfill. Sludges would be stabilized as required by state law using one or more of the approved methods prior to inclusion in the landfill.

Reclamation of landfill sites would include covering, contouring for proper drainage, and revegetation. Impacts would be limited to visual, noise, and site disturbances during use. Upon closure, the reclaimed site would be monitored for water quality impacts and reclamation success. A properly constructed, operated, and reclaimed site should limit significant long-term environmental impacts.

Sediment from the sediment ponds would be removed periodically to maintain pond capacity. The sediment would contain classified particles from erosion and pit dewatering activities. The material should represent the general composition of the existing overburden, interburden, and possibly coal site materials. Grain size of pond sediment would likely be smaller than the average site material. However, chemical composition should not be markedly different from a composite sample of the various site materials mixed at different proportions depending upon season and mining activity. The material may not be suitable for use in revegetation or for placement in the top soil zone due to higher than normal concentrations of parameters that could inhibit plant growth or the erosion potential of the smaller grain size distribution. Therefore, if pond sediment is found to be unsuitable, it would be buried under a layer (1.2 m [4 ft] minimum) of suitable erosion-resistant growth material.

The chemical composition of the sediment should be no more concentrated than individual geologic formations unless some natural flotation or gravity separation process is involved. However, the location and absence of weathering of sediments could result in greater reactivity of sediments. Therefore, monitoring will be necessary to fully assess short-term water quality impacts and suitability for use as plant growth media.

5.3.2.4 Biology

Mine Area

Construction, operation, and reclamation of the Diamond Chuitna Mine would result in a progression of changes over more than 30 years in the surface water quality and hydrology of mine area streams, primarily upper portions of Stream 2003. The nature and extent of these changes has been discussed above. Changes in the physical and chemical characteristics of the streams would cause changes in associated biota that would range from extreme and highly predictable (in cases of mining through existing drainages) to subtle and/or highly unpredictable (in adjacent streams such as Lone Creek and in downstream reaches of 2003). A major unknown is the time required to restore aquatic productivity to mined drainages. For the purpose of impact analysis, both the 10-year and 30-year impact scenarios have been considered (Tables 5-10 and 5-11).

Table 5-10

AQUATIC HABITAT EVALUATION OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (YEAR 10)(a)

DRAINAGE	20 CHUITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004	TOTALS
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEM	MAINSTEM	200403	-
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE (upper)	MIDDLE (lower)	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m	-
AFFECTED LENGTH (meters)	17910	3670	11340	6390	4610	3215	5645	4020	2820	1450	2100	4630	4830	3020	360	76010
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	4	4	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (i)	
AFFECTED AREA (m2)	404766	8808	41958	42813	8298	12860	22580	18492	3384	1740	5040	11112	15939	11778	360	609928
HOW AFFECTED	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	MINED	AREA DISTURBANCE	NIL	NIL	NIL	NIL	-
MAX. % HABITAT REDUCTION (b)	2	20	10	5	25	20	15	10	25	100	50	0	0	0	0	-
MAX. PERCENTAGE OF DOCUMENTED SYSTEM ESCAPEMENT USING REACH (c)																
- CHINOOK	31	0	0	7	0	0	7.7	6.3	0	0	0	0	4.6	3.4	0	60
- COHO	50	1.4	7.2	7.4	1	2.3	2.3	2.4	0	1	0	2.6	3.7	2.7	0	84
- PINK	80	0	5	5	1	3	3	3	0	0	0	0	0	0	0	100
MAXIMUM LOSS OF DOCUMENTED SPAWNERS (no.) (d)																
- CHINOOK	37.2	0	0	21	0	0	49.3	37.8	0	0	0	0	0	0	0	165.3
- COHO	25	7	18	9.25	6.25	11.5	8.625	6	0	25	0	0	0	0	0	116.625
- PINK	328	0	102.5	51.25	51.25	123	92.25	61.5	0	0	0	0	0	0	0	809.75
POTENTIAL SPAWNING DENSITY (no./km)																
- CHINOOK	150	10	100	200	10	100	100	150	10	10	10	50	60	100	10	
- COHO	20	20	50	180	30	50	50	50	20	20	20	30	50	50	20	
- PINK	1500	200	600	400	200	600	600	600	100	100	100	0	0	0	0	
MAXIMUM LOSS OF POTENTIAL SPAWNERS (no.)																
- CHINOOK	53.73	7.34	113.4	63.9	11.52	64.3	84.67	60.3	21.15	14.5	10.5	0	0	0	0	505.32
- COHO	7.164	14.68	56.7	57.51	34.57	32.5	42.33	20.1	42.3	29	21	0	0	0	0	357.5165
- PINK	537.3	146.8	680	128	232	386	508	241	211.5	145	105	0	0	0	0	3320
POTENTIAL REARING DENSITY (no./m2)																
- CHINOOK	0.7	0.5	0.7	0.7	0.5	0.7	0.7	2.25	0.5	0.5	0.5	0.5	0.7	0.7	0.5	
- COHO	0.6	2	3.1	1.2	2	2	2	1	2	3	2	2	3	1.2	2	
- RAINBOW/ DOLLY VARDEN	0.5	0.9	0.15	0.3	1	0.15	0.15	1	0.4	0.5	0.4	1.7	0.5	1	0.5	
MAXIMUM LOSS OF POTENTIAL REARING SALMONIDS (no.)																
- CHINOOK	5666.724	880.8	2937.	1498.	1037.	1800.	2370.	4160.	1269	870	1260	0	0	0	0	23751.28
- COHO	4857.192	3523.	13006.	2568.	4149	5144	6774	1849.	5076	5220	5040	0	0	0	0	57208.35
- RAINBOW/ DOLLY VARDEN	4047.66	1585.	629.3	642.1	2074.	385.8	508.0	1849.	1015.	870	1008	0	0	0	0	14615.41

(a) SOURCE: ERT (1984a, 1984b, 1985) FOR STREAM CHARACTERISTICS; SEE TABLE 4-11; POTENTIAL FISH USEAGE IS ESTIMATED USING BASELINE MEASUREMENTS (TABLE 4-11) AND THE ASSUMPTION THAT ACCESS PROBLEMS CREATED BY BEAVER ACTIVITY ARE REMOVED.

(b) REDUCTION ASSUMED TO BE 100% FOR STREAMS TO BE MINED THROUGH. REDUCTION IN HABITAT FOR DOWNSTREAM REACHES WERE ASSIGNED BASED ON COMBINED EFFECTS OF WATER QUALITY AND FLOW CHANGES AT THE HEIGHT OF PROJECT DISTURBANCE FOR THAT REACH.

(c) SEE TABLE 4-10. CHUITNA PERCENTAGES BASED ON ERT 1985 (TABLE 3.8-9); OTHER PERCENTAGES PROPORTIONED ON THE BASIS OF RATIOS OF REACH AREA AFFECTED TO TOTAL AREA OF THE REACH FOR WHICH SPAWNING DATA IS AVAILABLE. PERCENTAGE FOR PINK SALMON IN 2002 AND 2003 ASSUMED TO BE 10 BASED ON LARGE NUMBERS PRESENT IN 1980.

(d) MAXIMUM PERCENTAGE USING THE REACH TIMES THE MAXIMUM PERCENT HABITAT REDUCTION TIMES MAXIMUM DOCUMENTED SYSTEM ESCAPEMENT FROM TABLE 4-10.

(e) BASED ON MAXIMUM OBSERVED SPAWNER DENSITIES IN THE REACH IN QUESTION OR A COMPARABLE REACH IN AN ADJACENT SYSTEM; ASSUMES REMOVAL OF STREAM MIGRATION BARRIERS AND OPTIMUM OCEAN SURVIVAL.

(f) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL SPAWNING DENSITY TIMES REACH AREA (LENGTH).

(g) BASED ON MAXIMUM MEASURED REARING DENSITY (TABLE 4-11) IN THIS OR COMPARABLE REACH; ASSUMES REMOVAL OF ALL BARRIERS TO UPSTREAM MIGRATION.

(h) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL REARING DENSITY TIMES REACH AREA (m2).

Table 5-11

AQUATIC HABITAT EVALUATION OF POTENTIALLY AFFECTED REACHES OF MINE AREA STREAMS (YEAR 30)(a)

DRAINAGE	20 CHULITNA R.	2002 LONE CR.	2002 LONE CR.	2002 LONE CR.	2003	2003	2003	2003	2003	2003	2003	2004	2004	2004	2006	TOTALS
TRIBUTARY	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	MAINSTEM	200304	200305	200306	MAINSTEM	MAINSTEM	MAINSTEM	200603	-
REACH	BELOW 2003	UPPER	MIDDLE	LOWER	UPPER	MIDDLE (upper)	MIDDLE (lower)	LOWER	ENTIRE	ENTIRE	ENTIRE	UPPER	MIDDLE	LOWER	UPPER 360 m	-
AFFECTED LENGTH (meters)	17910	3670	11340	6390	4610	3215	5645	4020	2820	1450	2100	4630	4830	3020	360	76010
MEAN WIDTH (meters)	22.6	2.4	3.7	6.7	1.8	4	4	4.6	1.2	1.2	2.4	2.4	3.3	3.9	1 (i)	
AFFECTED AREA (m2)	404766	8808	41958	42813	8298	12860	22580	18492	3384	1740	5040	11112	15939	11778	360	609928
HOW AFFECTED	WQ/FLOW	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	MINED	WQ/FLOW	WQ/FLOW	MINED	MINED	MINED	WQ/FLOW	WQ/FLOW	WQ/FLOW	MINED	-
MAX. % HABITAT REDUCTION (b)	5	40	20	10	100	100	80	25	100	100	100	10	20	15	100	-
MAX. PERCENTAGE OF DOCUMENTED SYSTEM ESCAPEMENT USING REACH (c)																
- CHINOOK	31	0	0	7	0	0	7.7	6.3	0	0	0	0	4.6	3.4	0	60
- COHO	50	1.4	7.2	7.4	1	2.3	2.3	2.4	0	1	0	2.6	3.7	2.7	0	84
- PINK	80	0	5	5	1	3	3	3	0	0	0	0	0	0	0	100
MAXIMUM LOSS OF DOCUMENTED SPAWNERS (no.) (d)																
- CHINOOK	93	0	0	42	0	0	369.6	283.5	0	0	0	0	55.2	30.6	0	873.9
- COHO	62.5	16	36	18.5	25	57.5	46	45	0	25	0	6.5	18.5	10.12	0	364.625
- PINK	820	0	205	102.5	205	615	492	461.2	0	0	0	0	0	0	0	2900.75
POTENTIAL SPAWNING DENSITY (no./km)																
- CHINOOK	150	10	100	200	10	100	100	150	10	10	10	50	60	100	10	
- COHO	20	20	50	180	30	50	50	50	20	20	20	30	50	50	20	
- PINK	1500	200	600	400	200	600	600	600	100	100	100	0	0	0	0	
MAXIMUM LOSS OF POTENTIAL SPAWNERS (no.)																
- CHINOOK	134.325	14.68	226.8	127.8	46.1	321.5	451.6	452.2	28.2	14.5	21	23.15	57.96	45.3	3.6	1968.765
- COHO	17.91	29.36	113.4	115.0	138.3	160.7	225.8	150.7	56.4	29	42	13.89	48.3	22.65	7.2	1170.73
- PINK	1343.25	293.6	1361	256	927	1929	2710	1809	282	145	210	0	0	0	0	11263
POTENTIAL REARING DENSITY (no./m2)																
- CHINOOK	0.7	0.5	0.7	0.7	0.5	0.7	0.7	2.25	0.5	0.5	0.5	0.5	0.7	0.7	0.5	
- COHO	0.6	2	3.1	1.2	2	2	2	1	2	3	2	2	3	1.2	2	
- RAINBOW/ DOLLY VARDEN	0.5	0.9	0.15	0.3	1	0.15	0.15	1	0.4	0.5	0.4	1.7	0.5	1	0.5	
MAXIMUM LOSS OF POTENTIAL REARING SALMONIDS (no.)																
- CHINOOK	14166.81	1761.	5874.	2996.	4149	9002	12644	31205	1692	870	2520	555.6	2231.	1236.	180	91086.24
- COHO	12142.98	7046.	26013	5137.	16596	25720	36128	13869	6768	5220	10080	2222.	9563.	2120.	720	179347.7
- RAINBOW/ DOLLY VARDEN	10119.15	3170.	1258.	1284.	8298	1929	2709.	13869	1353.	870	2016	1889.	1593.	1766.	180	52308

(a) SOURCE: ERT (1984a, 1984b, 1985) FOR STREAM CHARACTERISTICS; SEE TABLE 4-11; POTENTIAL FISH USEAGE IS ESTIMATED USING BASELINE MEASUREMENTS (TABLE 4-11) AND THE ASSUMPTION THAT ACCESS PROBLEMS CREATED BY BEAVER ACTIVITY ARE REMOVED.

(b) REDUCTION ASSUMED TO BE 100% FOR STREAMS TO BE MINED THROUGH. REDUCTION IN HABITAT FOR DOWNSTREAM REACHES WERE ASSIGNED BASED ON COMBINED EFFECTS OF WATER QUALITY AND FLOW CHANGES AT THE HEIGHT OF PROJECT DISTURBANCE FOR THAT REACH.

(c) SEE TABLE 4-10. CHULITNA PERCENTAGES BASED ON ERT 1985 (TABLE 3.8-9); OTHER PERCENTAGES PROPORTIONED ON THE BASIS OF RATIOS OF REACH AREA AFFECTED TO TOTAL AREA OF THE REACH FOR WHICH SPAWNING DATA IS AVAILABLE. PERCENTAGE FOR PINK SALMON IN 2002 AND 2003 ASSUMED TO BE 10 BASED ON LARGE NUMBERS PRESENT IN 1980.

(d) MAXIMUM PERCENTAGE USING THE REACH TIMES THE MAXIMUM PERCENT HABITAT REDUCTION TIMES MAXIMUM DOCUMENTED SYSTEM ESCAPEMENT FROM TABLE 4-10.

(e) BASED ON MAXIMUM OBSERVED SPAWNER DENSITIES IN THE REACH IN QUESTION OR A COMPARABLE REACH IN AN ADJACENT SYSTEM; ASSUMES REMOVAL OF STREAM MIGRATION BARRIERS AND OPTIMUM OCEAN SURVIVAL.

(f) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL SPAWNING DENSITY TIMES REACH AREA (LENGTH).

(g) BASED ON MAXIMUM MEASURED REARING DENSITY (TABLE 4-11) IN THIS OR COMPARABLE REACH; ASSUMES REMOVAL OF ALL BARRIERS TO UPSTREAM MIGRATION.

(h) PRODUCT OF MAXIMUM % HABITAT REDUCTION TIMES POTENTIAL REARING DENSITY TIMES REACH AREA (m2).

At the 10-year point in mine development, 4.3 km (2.67 mi) of smaller tributaries to Stream 2003 would be mined through, in various stages of preparation for mining, or occupied by sediment ponds (Table 5-10). Full development of the 30-year mine pit would result in the direct destruction of some 14.6 km (9.1 miles) of stream habitat, mostly (98 percent) in system 2003 (Table 5-11). Measured or extrapolated levels of anadromous fish use (spawning and rearing) of these areas is generally high (Table 4-11).

Available information suggests that downstream impacts due to changes in water quality would be minimal except where sediment pond discharges comprise a major percentage of streamflow. The applicant intends to meet all applicable state and federal water quality standards. Nonetheless, extended periods of above-ambient levels of suspended sediments and turbidity would inevitably result from instream and in-drainage work in the mine area and from sediment retention pond discharges, especially during the winter.

Heavy siltation can smother aquatic invertebrates that comprise roughly one-half or more of the diet of trout and salmon in small streams (Dames & Moore 1976). Loss of interstices among larger gravel and cobbles removes areas of refuge for fry and may increase predation loss to birds or larger fish. Emergence pathways may also be blocked, resulting in delayed emergence or entombment of alevins (Phillips et al. 1975).

Siltation can also reduce fish production by reducing circulation of aerated water through the spawning gravel necessary for survival of eggs and alevins (Mason 1969). High turbidity (e.g., greater than 30 N.T.U.) greatly reduces feeding efficiency (Berg and Northcote 1985). Reduced light penetration of turbid water, if prolonged, may decrease growth of periphyton on which some fish food organisms subsist. Healthy fish adapted to living in streams which traditionally flood at least once a year protect their gills by secretion of mucus to carry off the irritants. Prolonged exposure of fish to high concentrations of suspended particles with a hardness greater than one may cause damage to the gills and, in extreme cases, lead to death (EIFAC 1965; Cordone and Kelly 1961). The effect of natural siltation in local creeks is minimized by its association with periods of high runoff when stream velocities and turbulance are great enough to prevent significant deposition. Introduction of silt into streams during periods of low flow, when deposition is greatest, has a far more damaging impact on stream biota. Recent work by Berg and Northcote (1985) has shown that even short pulses of turbid water in the 30-60 NTU range reduces not only coho juvenile feeding efficiency but territorial behavior patterns as well.

The planned erosion and water quality control program for construction and operations should reduce sediment introduction during critical low flow periods. Erosion control measures also would reduce inputs during high runoff periods. However, some siltation would be inevitable as a result of work in and near streams, normal sediment retention pond discharges, or overloading of silt collection facilities during heavy rainfall. Some reduction in the abundance of benthic fauna and reduced growth rates of fish would likely result in stream areas near discharge points. Reduced survival of salmonid eggs and alevins in the stream bed gravels could occur downstream of discharge points (e.g., middle and lower 2003) when such sediments remain in spawning gravels during the winter intragravel development period for salmon. Discharges of water containing suspended materials under ice in the winter may be particularly harmful. If water quality standards are met during mine operation, sediment impacts would probably not be significant.

In addition to occasional introduction of above ambient suspended sediment loads, sediment pond discharges may intermittently contain levels of zinc approaching standards required for protection of aquatic life. Toxic effects of many trace metals, including zinc, on aquatic life are known to be highly dependent on water pH, hardness, and (less predictably) temperature (EPA 1972; Hodson and Sprague 1975). Acute toxicity generally increases with decreasing pH (below 7.0) as a result (in part at least) of the increased mobility and bioavailability of metals (EPA 1976). The pH values in surface waters of the study area are slightly basic, generally ranging between 7.5 to 8.5. Increasing hardness (commonly reported as equivalent concentration of calcium carbonate) reduces the toxic effects of divalent metal ions such as copper, lead, zinc, and cadmium (EPA 1976). Hardness in study area waters is typically low, ranging between 10 and 50 mg/l (as $CaCO_3$) with higher values during periods of lower flow and vice versa, thus little reduction in metal toxicity would be expected. Effects of temperature on metal toxicity are more variable with increased or decreased toxicity depending on species, acclimation temperature, exposure temperature, and metals concentration (whether above or below acutely lethal levels) (Hodson and Sprague 1975; Cairns et al. 1975).

Brown (1976) has suggested that fish can tolerate toxic metals up to a given concentration by actively secreting them back into the water (via gills or kidney) or by having them bound to a specific protein (metallothionein). However, once a threshold value is reached, only a slightly higher concentration causes mortality (the "spill-over hypotheses"). Roch et al. (1982), in studies of fish populations in contaminated reaches of the Campbell River system (British

Columbia), concluded that metallothionein concentration was a useful measure of the degree of exposure to fish to heavy metals.

Levels of zinc projected for intermittent release from the ponds (0.04 mg/l) approach the EPA 24-hour average criterion for zinc (0.047 mg/l). These levels are all well below the maximum level of 0.534 mg/l shown by Holcombe et al. (1979) to have no effect on survival, growth, or reproduction in brook trout. They are also below the maximum level of 0.112 mg/l shown by Chapman (1978) to have no effect on adult to smolt survival, fertility, fecundity, growth, or saltwater adaptability of sockeye salmon. Exposure to 0.242 mg/l similarly had no effect over the embryo to smolt exposure period for sockeye. Thus, no measureable effects are expected on study area fish due to zinc exposures.

Another possible, but unpredictable, impact on salmon related to water quality concerns the fact that adult salmon identify their home stream by "smelling" the water. The addition of sediment or small concentrations of metallic pollutants would be unlikely to interfere with this ability. However, the transfer of water from one watershed to another, or, as is the case with Stream 2003, the elimination of headwaters could alter water chemistry to a sufficient degree to confuse homing ability. Such confusion could result in spawning occurring in marginal habitat or, at worst, elimination of a tributary as spawning habitat. Water allocation to various streams from the sediment pond and diversion systems would vary with the extent of mine development.

Changes in stream flow downstream of the mine pit on all three streams (Lone Creek, 2003, and 2004) during operation would result in changes in stream habitat for anadromous salmonids. Altered stream flow can have varied impacts on fish habitats depending on the direction and magnitude of the change, the time of year the change occurs, and the nature of fish populations present. ERT (1985c) performed a study to evaluate effects of altered stream flows on fish habitat in Lone Creek and Stream 2003 for the first 10 years of mine life using the instream flow incremental methodology (IFIM) developed by the U.S. Fish and Wildlife Service (Bovee 1982). Their results indicate that for "normal" water years, slightly decreased flows (0.028 m^3/sec [1 cfs] reduction at all stations and times was assumed) would have a variety of effects on fish habitat. During summer and fall, the reduced flows would generally result in reduced habitat for coho juvenile and spawning chinooks while increasing habitat for chinook juveniles. Flow reductions used in these analyses do not reflect the maximum projected over the 30-year project life and do not evaluate the potential impacts during winter, which may be the most critical time period for fish.

Based on available information on the cumulative effects of all of the physical and chemical alterations likely downstream of the mined area, a subjective estimate has been formulated of a likely resultant reduction in fish habitat in these reaches ("maximum percentage habitat reduction") for the 10 year and 30 year scenarios (Tables 5-10 and 5-11). This maximum percentage habitat reduction factor logically can range from 0 percent (no change in habitat) to 100 percent (complete destruction of the stream as it is mined through). Intermediate values are based largely on the maximum reduction in minimum stream flow that would occur when no return flow is provided to the streams from ground water entering the pit. During the summer months, the effects of this unlikely and short term occurrence (e.g., due to pump or power failure) could be readily modelled using the IFIM for selected species and life history stages (Diamond Alaska Coal Company 1985). Such an analysis would likely show changes in habitat for a given flow change that vary in magnitude and direction with species and life history stage. The most damaging summertime scenario would occur if a flow reduction caused drying of redds containing pink or chinook salmon eggs. However, IFIM is not appropriate for modeling changes in habitat that would occur due to the more likely scenario where cold weather causes the water entering the pit to freeze resulting in interception of ground water which normally would be pumped to the streams. Because limited data are available to address this condition and because of its likelihood of occurrence, the predicted winter flow reductions (Table 5-7) have been used as the primary basis for assigning the maximum percent habitat reduction values. These values are considered to be indicative of the relative magnitude of habitat reduction that might be experienced between stream reaches subjected to varying degrees of project-related impacts. It should be noted, however, that the values are based on no pit water pumping back into streams and on a series of assumptions used in the absence of field data. The resultant values should be used as "order-of-magnitude estimates to be used for qualitative assessment of mine-related impacts" rather than quantitative indices based on measured or simulated data.

This estimated percentage reduction is used to weigh fish habitat loss estimates and to calculate resultant fish losses. It is assumed that there is a one to one relationship between habitat loss and fish loss. This would occur only if habitat is limiting to the species/life history stage in question, which is unlikely in portions of these streams to which beaver dams appear to limit access. In addition, it would only occur if the flow (i.e., habitat) reduction was prolonged; for example, a few days of lowered flows during the summer might reduce fish growth rates somewhat but would be unlikely to cause significant mortalities. This application is therefore conservative and represents a worst-case scenario.

Because access to many areas of the three mine area tributaries is severely limited by beaver dams (Dames & Moore 1980; Diamond Alaska Coal Company 1985), there is a high degree of variability in numbers of adults using the middle and upper reaches of these streams from year to year. Therefore, combined losses from both direct habitat loss in the pit area and indirect downstream effects have been calculated two ways (Tables 5-10 and 5-11): 1) using maximum documented spawner densities, and 2) using estimated potential maximum densities of both spawners and rearing fish. Calculations using potential maximum densities indicate that at year 10, habitat for 505 chinook, 360 coho, and 3,320 pink adults might be lost, assuming a maximum escapement for each species and assuming that fish encountering this habitat degradation do not successfully spawn elsewhere.

As discussed in the surface hydrology section, the period of maximum hydrological impact would occur in the later years of mining and in the early years of reclamation perhaps occupying years 20 through 30 of mine life. Worst case impacts would apply to this time period. As shown on Table 5-11, at the 30-year point in mine life, habitat for a calculated 1,970 chinook, 1,170 coho, and 11,300 pink salmon spawners might be lost under the worst case assumptions stated above.

Using the maximum documented (c.f. potential) spawning density in a similar calculation (Table 5-10) yields substantially lower adult loss figures: 165 chinook, 115 coho, and 810 pink spawners lost at the 10-year point due to habitat degradation (assuming that fish encountering this lost habitat do not successfully spawn elsewhere). These losses would constitute reductions of 2.8, 4.6 and 4.0 percent, respectively, of the maximum estimated system escapements for chinook, coho, and pink salmon (Table 4-12). At the 30-year point in mine life, a similar calculation gives an estimated habitat loss for 875 chinook, 365 coho, and 2,900 pink salmon spawners (14.6, 14.6 and 14.2 percent, respectively, of the maximum estimated system escapements).

In addition, habitat for 23,750 juvenile chinook, 57,200 juvenile coho, and 14,600 juvenile and adult rainbow and Dolly Varden also could be lost at year 10 (Table 5-10). These losses of juvenile habitat would result in a potential additional loss of some 238 and 571 returning adult chinook and coho salmon, respectively, assuming a 1 percent juvenile-to-adult survival. At the 30-year point in mine life (Table 5-11), habitat losses could affect 91,000 chinook, 179,300 coho, and 52,300 rainbow and Dolly Varden. These losses of juvenile habitat, if realized, could result in the loss of approximately 911 chinook and 1,793 coho adults - a very high percentage of the maximum documented total system escapement.

Obviously, these numbers are highly conservative in that they assume coincident loss of all stream habitats that would be affected by mine operation. They also assume maximum potential values of fish usage. Finally, these loss calculations have assumed the worst case flow reduction factors for each reach based on Table 5-7 which assumes interruption of the normal return flow to the streams from pit dewatering as discussed above. In actuality, there would be a loss of flow, hence productivity, in each creek for some years as the mine pit is progressively excavated and backfilled and the stream is rehabilitated. The degree of success with which streams can be rehabilitated is unknown and would depend on the level of effort expended, the degree to which the existing physical habitat can be reconstructed, and perhaps most importantly, the rate of ground-water recharge. Certainly there would be a long term (e.g., several decades or more) loss of habitat due to the difficulty of reconstructing habitat as good as naturally exists and due to loss of habitat area where highly sinuous stream reaches are replaced by straighter reaches.

Using the habitat value ratings assigned for the several stream reaches in the mine area, the wetted surface area of each reach, and the estimated maximum percent habitat loss (Tables 5-10 and 5-11), the area of habitat lost in each category for each species has been calculated for the 10-year and 30-year mine scenario (Tables 5-12 and 5-13). These calculations show a moderate potential loss after 10 years of 1.21 ha (2.99 ac) of very high quality chinook habitat in the lower reaches of the three tributaries and in the Chuitna River itself (4.02 ha [9.9 ac] after 30 years). Another 1.01 ha (2.5 ac) of high quality chinook habitat would be lost in the middle reaches of the three tributaries after 10 years (4.25 ha [10.50 ac] after 30 years). Very high quality coho habitat (1.02 ha [2.52 ac]) would be lost from the middle reaches of each tributary after 10 years (4.02 ha [9.9 ac] after 30 years) with additional loss of high quality coho habitat in all other area waters. High quality pink spawning habitat (2.43 ha [6.0 ac] and 8.60 ha [21.2 ac] after 10 and 30 years, respectively) would be lost from the mainstream of Lone Creek and 2003 where heavy spawning was noted in 1980.

Table 5-12

WEIGHTED MAXIMUM POTENTIAL HABITAT LOSS (HA) BY LOCALLY ASSIGNED CATEGORY, DRAINAGE AND SPECIES (YEAR 10)

		Evaluation Species			
Habitat Value	**System**	**Chinook**	**Coho**	**Pink**	**Rainbow/Dolly Varden**
Very High	- Chuitna	0.81	0	0	0
	- 2002	0.21	0.42	0	0
	- 2003	0.18	0.60	0	0
	- 2004	0	0	0	0
High	- Chuitna	0	0.81	0.81	0.81
	- 2002	0.42	0.39	0.63	0.18
	- 2003	0.60	1.07	1.00	0.39
	- 2004	0	0	0	0
Medium	- Chuitna	0	0	0	0
	- 2002	0.18	0	0.18	0.63
	- 2003	0.42	0	0	1.28
	- 2004	0	0	0	0
Low	- Chuitna	0	0	0	0
	- 2002	0	0	0	0
	- 2003	0.46	0	0.68	0
	- 2004	0	0	0	0
Total Potential Loss					
	- Very High	1.21	1.02	0	0
	- High	1.02	2.27	2.43	1.38
	- Medium	0.60	0	0.18	1.91
	- Low	0.46	0	0.68	0

---

[1] This area is the sum of the products of area and maximum habitat reduction (Table 5-11) for each reach with the habitat value in question.

Table 5-13

WEIGHTED MAXIMUM POTENTIAL HABITAT LOSS (HA) BY LOCALLY ASSIGNED CATEGORY, DRAINAGE AND SPECIES (YEAR 30)

		Evaluation Species			
Habitat Value	System	Chinook	Coho	Pink	Rainbow/Dolly Varden
Very High	- Chuitna	2.02	0	0	0
	- 2002	0.43	0.84	0	0
	- 2003	1.39	3.09	0	0
	- 2004	0.18	0.04	0	0
High	- Chuitna	0	2.02	2.02	2.02
	- 2002	0.84	0.78	1.27	0.35
	- 2003	3.09	3.23	5.31	2.22
	- 2004	0.32	0.32	0	0.39
Medium	- Chuitna	0	0	0	0
	- 2002	0.35	0	0.35	1.27
	- 2003	0.51	0	0	4.11
	- 2004	0.15	0	0	0.35
Low	- Chuitna	0	0	0	0
	- 2002	0	0	0	0
	- 2003	1.33	0	1.02	0
	- 2004	0	0	0.64	0
Total Potential Loss					
	- Very High	4.02	3.97	0	0
	- High	4.25	6.36	8.60	4.88
	- Medium	1.01	0	0.35	5.73
	- Low	1.33	0	1.66	0

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[1] This area is the sum of the products of area and maximum habitat reduction (Table 5-12) for each reach with the habitat value in question.

5.3.3 Impacts to the Marine Environment

Increased dissolved and suspended solids in the Chuitna River would increase slightly the load of these materials entering Cook Inlet. Because of the tremendous natural sediment load of Inlet waters, the effect of any increases from the Chuitna River on the marine environment would be insignificant.

5.3.4 Air Quality Impacts

Ambient air quality monitoring data are not available for the project site. Air quality monitoring done in the project region, however, demonstrates that ambient air quality levels are well below the National Ambient Air Quality Standards (NAAQS). Current ambient air quality levels at the project site are therefore expected to be in attainment with the NAAQS (see Section 4.6.2). Since air quality modeling was done for the whole project, the following discussion will cover the mine, mine service area, ports, transportation corridors, and housing sites.

5.3.4.1 Emissions

The project would generate emissions of several pollutants including nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), hydrocarbons (HC), particulate matter (PM), and lead (Pb). Any project, before it can be permitted, must demonstrate the ability to comply with the NAAQS for these pollutants. All projects must also show compliance with the Prevention of Significant Air Quality Deterioration (PSD) increments for SO_2 and PM (stationary sources only). Air emission controls for specific activities are given in more detail in Appendix E.

Due to the large amount of particulates associated with mining projects, particulate emissions are of special concern. Air quality impact analyses have been performed to quantify the PM and SO_2 impacts associated with the project (TRC Environmental Consultants 1986, 1987a, 1987b). An analysis of air emissions (assuming that full production would be reached after 4 years) showed that the third and fourth years of coal production would have the largest emissions of particulate matter, the pollutant of greatest concern (TRC Environmental Consultants 1987b). Delayed phase-up to full production would mitigate air quality impacts somewhat because higher coal production levels would occur during later years of the project when the amounts of overburden to be removed would be less. However, this mitigating effect would not be expected to be substantial and largest emissions would still occur in the third and fourth years.

Production phase emissions sources would include those which produce particulate matter only and those which produce gaseous pollutants (NO_x, SO_2, CO, PM, and THC). Particulates sources would include coal and overburden handling activities and vehicle travel over unpaved roads. Gaseous pollutant sources would include bulldozer, ship, and other vehicle tailpipe emissions and slash burning. Annual emissions from all significant sources of particulate matter are shown in Table 5-14. The estimates are called intermediate production and full production, corresponding to the third and fourth years of production, and represent maximum emissions and impacts. Annual gaseous pollutant emissions are presented in Table 5-15. Short-term particulate emissions for full production and production year 3 are presented in Tables 5-16 and 5-17, respectively. Calculations of all emissions plus discussions of potential but insignificant air emissions sources are given in Appendix E. Where feasible, emissions were assigned to one of the four functional areas of the project: the mine area, the mine services area, the port facility, or the housing facility. Emissions which do not occur in one of the four functional areas, such as overland conveyor emissions or miscellaneous vehicle emissions, are classed under general project area emissions.

Slash burning emissions would require a separate permit. It was the applicant's initial plan to bury the slash material in the backfill areas of the pit. However, other Alaska State agencies have expressed concerns regarding bark beetle populations in the slash materials and have requested burning as a disposal method.

Production phase emissions given in Tables 5-14 and 5-15 are subject to both the NAAQS and PSD increments. In addition to the production phase emissions from the project, there would be construction and other temporary emissions. The construction emissions would consist of land clearing and slash burning emissions and would occur during the first three years of the project. The temporary emissions would consist of the emissions from overland truck coal haul during the first two years of coal production before the overland conveyor is constructed. These construction and temporary sources must comply with the NAAQS, but are exempt from the PSD increments. These construction and temporary sources would primarily emit particulates. Particulate emissions associated with these sources are given in Table 5-18.

The final category of emissions associated with the project are the secondary emissions from power generation. A nearby utility would provide generation capacity to accommodate the Diamond Chuitna project. Diamond Chuitna's needs for this project would be approximately 33 megawatts on

Table 5-14

PRODUCTION-PHASE ANNUAL PARTICULATE EMISSIONS

Source	Intermediate Production Emissions (ton/yr)	Full Production Emissions (ton/yr)
Mine Area:		
Land clearing/reclamation	55.5	55.5
Overburden removal - truck shovel	0.1	0.1
Overburden removal - dragline	165.0	221.4
Overburden hauling	225.6	62.9
Overburden dumping	0.1	0.1
Coal removal	6.3	12.6
Coal hauling	43.6	87.3
Coal dumping	0.0	0.0
Coal primary crushing	0.6	1.2
Wind erosion	38.0	35.9
Haul road maintenance/graders	15.6	15.6
Mine area combustion sources(a)	35.0	30.4
Mine Area Subtotal:	585.4	523.0
Mine Service Area:		
Secondary coal crushing	1.8	3.6
Coal screening	3.0	6.0
Coal handling	0.0	0.0
Coal stockpile	20.5	20.5
Wind erosion	10.0	10.0
Mine Service Area Subtotal:	35.3	40.1
Port Area:		
Coal handling	0.0	0.0
Coal stockpile	218.1	218.1
Wind erosion	11.9	11.9
Port area combustion sources	6.6	6.6
Port Area Subtotal:	236.6	236.6
Housing Area:		
Housing area combustion sources(a)	7.7	7.7
Housing Area Subtotal:	7.7	7.7
General Project Area:		
Overland conveyor	8.4	8.4
Miscellaneous vehicle traffic	9.1	9.1
General Project Area Subtotal:	17.5	17.5
TOTAL	882.5	824.9

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

(a)Further delineated in Table 5-15.

Table 5-15

GASEOUS AND PARTICULATE ANNUAL COMBUSTION EMISSIONS

Source	Annual Emissions (tons per year)				
	NO_x	SO_2	CO	VOC	PM
Mine Area					
Slash burning	4.8	0.0	167.9	28.9	20.4
Haul trucks	96.3(172.8)[b]	10.5(19.1)	27.0(48.1)	4.3(8.0)	5.9(10.5)
Dozers	92.8	7.8	40.0	4.3	3.7
Graders	4.3	0.5	0.9	0.2	0.4
Fuel Storage	—	—	—	3.0	—
Mine Area Subtotal	198.2(274.7)	18.8(27.4)	235.8(256.9)	40.7(44.4)	30.4(35.0)
Port Area					
Ships	15.0	95.1	2.1	0.2	6.6
Fuel Storage	—	—	—	11.1	—
Housing Facility					
Incinerator	3.3	2.7	11.0	3.3	7.7
General Project Area					
Miscellaneous vehicles	0.1	0.0	0.7	0.1	0.0
Total	216.6 (293.3)	216.6 (225.2)	249.6 (270.7)	55.4 (59.1)	44.7 (49.3)

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[a] Haul truck emissions include overburden and coal handling.

[b] Numbers in parentheses reflect emissions for production year 3 where these differ from full production emissions.

Table 5-16

FULL PRODUCTION SHORT-TERM PARTICULATE EMISSIONS

Source	Full Production Emissions (lb/hr)
Mine Area:	
Land clearing/reclamation	13.7(a)
Overburden removal - truck shovel	0.0
Overburden removal - dragline	50.6
Overburden hauling	14.4(b)
Overburden dumping	0.0
Coal removal	2.9
Coal hauling	19.9(b)
Coal dumping	0.0
Coal primary crushing	0.3
Wind erosion	8.2
Haul road maintenance/graders	5.1(c)
Mine area combustion sources	2.2(1.3)(d)
Mine Area Subtotal:	117.3(116.4)
Mine Service Area:	
Secondary coal crushing	0.4
Coal screening	0.7
Coal handling	0.0
Coal stockpile	4.7
Wind erosion	2.3
Mine Service Area Subtotal:	8.1
Port Area:	
Coal handling	0.0
Coal stockpile	49.8
Wind erosion	2.7
Port area combustion sources	3.5(d)
Port Area Subtotal:	56.0
Housing Area:	
Housing area combustion sources	3.5(d)
Housing Area Subtotal:	3.5
General Project Area:	
Overland conveyor	2.1
Miscellaneous vehicle traffic	2.1
General Project Area Subtotal:	4.2
TOTAL	189.1(188.2)[e]

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

(a) Based on 338 days per year versus 365 days per year.

(b) Based on an AP-42 average silt loading of 40.8 g/m^2 versus an erroneous ADEC factor of 10.6 g/m^2.

(c) Based on 50 percent control for watering instead of 85 percent control for chemical application.

(d) Only haul truck combustion source emissions were included in the modeling. Emissions are based on annual emissions as given in Table 5-15. Note that slash burning emissions were not included in the short-term emissions, as slash burning would not occur simultaneously with the majority of the mine area emissions.

(e) These were emissions used in particulate air dispersion modeling.

Table 5-17

PRODUCTION YEAR 3 SHORT-TERM PARTICULATE EMISSIONS

Source	Production Year 3 Emissions (lb/hr)
Mine Area:	
Land clearing/reclamation	13.7[a]
Overburden removal - truck shovel	0.0
Overburden removal - dragline	37.7
Overburden hauling	51.5[b]
Overburden dumping	0.0
Coal removal	1.4
Coal hauling	10.0[b]
Coal dumping	0.0
Coal primary crushing	0.1
Wind erosion	8.7
Haul road maintenance/graders	5.1[c]
Mine area combustion sources	3.3
Mine Area Subtotal:	131.5
Mine Service Area:	
Secondary coal crushing	0.4
Coal screening	0.7
Coal handling	0.0
Coal stockpile	4.7
Wind erosion	2.3
Mine Service Area Subtotal:	8.1
Port Area:	
Coal handling	0.0
Coal stockpile	49.8
Wind erosion	2.7
Port area combustion sources	3.5
Port Area Subtotal:	56.0
Housing Area:	
Housing area combustion sources	3.5
Housing Area Subtotal:	3.5
General Project Area:	
Overland conveyor	2.1
Miscellaneous vehicle traffic	2.1
General Project Area Subtotal:	4.2
TOTAL	203.3

Note: Emission rates listed as 0.0 are less than 0.05 tons per year.

[a] Based on 338 days per year versus 365 days per year.

[b] Based on an AP-42 average silt loading of 40.8 g/m^2 versus an erroneous ADEC factor of 10.6 g/m^2.

[c] Based on 50 percent control for watering instead of 85 percent control for chemical application.

Table 5-18

CONSTRUCTION AND TEMPORARY EMISSIONS

	Annual Emissions (tons per year)				
Source	NO_x	SO_2	CO	VOC	PM
Construction					
Land Clearing					
-Fugitive Dust	--	--	--	--	61.6
-Tailpipe Exhaust	103.0	8.6	44.3	4.7	4.1
Slash Burning	4.8	0.0	167.6	28.8	20.4
Total Construction	107.8	8.6	211.9	33.5	86.1
Temporary					
Overland Truck Coal Haul					
-Fugitive Dust	--	--	--	--	343.0
-Tailpipe Exhaust	220.3	24.0	61.6	10.0	13.6
Total Temporary	220.3	24.0	61.6	10.0	356.6

an annual average basis, while peak demand would be up to 55 megawatts. Table 5-19 shows typical peak hourly and annual average air emissions associated with this demand. These emissions are calculated assuming one 30 MW turbine for average demand and two 30 MW turbines operating to meet peak demand.

The major air emission control measures currently proposed for the project include the application of water and dust control chemicals to the haul roads, installing baghouse devices on the crushers, hooding of the overland conveyor, application of water, as needed, to the stockpiles, and compaction of the unused portions of the stockpiles.

5.3.4.2 Air Dispersion Modeling Results

Air dispersion modeling (TRC Environmental Consultants 1986, 1987a, 1987b, 1988) was performed to determine the short-term and long-term impacts of production phase particulate emissions on ambient air quality. The Industrial Source Complex (ISC) model was used for this analysis. It is an EPA-approved air quality dispersion model. The emission sources were grouped according to location as follows:

- pit sources: those located in the area where the mining and overburden removal operations are ongoing
- mine area haul roads: including the haul trucks, other vehicles, and graders
- mine facilities area: including crushers, conveyors, and the mine stockpile
- overland conveyor
- port area: including the port conveyor operations, the port stockpile, and the ships

Table 5-20 shows the modeled particulate matter impacts for the intermediate and full production years. Based on air dispersion modeling results, the project is in compliance with the previous TSP and new PM_{10} ambient standards, as well as the PSD increments for TSP and the project is in conformance with the Alaska State Implementation Plan. Factors used in modelling and calculation of individual component source emissions are found in Appendix E.

The ISC model was also used to determine the impact of overland truck haul emissions on ambient air quality. Peak 24-hour average concentrations for these temporary construction emissions were approximately 57 micrograms per cubic meter. This concentration, even if added to a conservative background concentration of 50 micrograms per cubic meter, is still well below the previous 150 microgram

Table 5-19

POTENTIAL TURBINE EMISSIONS ASSOCIATED WITH POWER GENERATION FOR THE DIAMOND CHUITNA PROJECT

	Gas Firing	
Pollutant	Peak Hourly (lb/hr)	Annual Average (tpy)
NO_x	165.1	723
SO_2	negligible	negligible
PM	5.7	25.0
VOC	1.7	7.6
CO	11.1	48.6

Table 5-20

AIR QUALITY MODELING ANALYSIS
TOTAL SUSPENDED PARTICULATE (TSP) CONCENTRATIONS

Production Phase/Averaging Period	Modeled TSP Concentration (ug/m^3)	Background TSP Concentration (ug/m^3)	Total TSP Concentration (ug/m^3)	PM10(a) Ambient Standard (ug/m^3)	TSP(b) PSD Increment (ug/m^3)
Intermediate Production					
24-hour	34.5	50.0(c)	84.5	150	37
Annual	3.5(e)	9.0(d)	12.5	50	19
Full Production					
24-hour	36.8	50.0(c)	86.8	150	37
Annual	3.5(e)	9.0(d)	12.5	50	19

(a) The total concentration should be compared with the ambient standards for PM10, since PM10 concentrations will always be less than or equal to the TSP concentrations.

(b) The modeled TSP concentrations should be compared with the PSD increments.

(c) Second highest value observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981 to May 31, 1982 (Radian 1982).

(d) Average TSP concentration observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981 to May 31, 1982.

(e) Annual impacts based on air quality impact analysis prepared by TRC Environmental Consultants, December 11, 1986 and submitted to the Alaska Department of Environmental Conservation. These correspond to particulate matter emissions of 527.8 tons per year at the mine and mine services area and 87.3 tons per year at the port area.

per cubic meter TSP and the new PM_{10} ambient standards. As the overland truck haul emissions are a temporary source, PSD increments would not apply.

The only other pollutant of significant concern for this project is sulfur dioxide (SO_2) which is emitted from oil combustion in the ship boilers during "hoteling" operations in port. Table 5-21 shows the SO_2 impacts associated with coal ship operations at the port. Peak predicted concentrations for 3-hour and 24-hour averaging periods were 122 ug/m^3 and 21 ug/m^3, respectively. The values are well below the applicable 3-hour and 24-hour sulfur dioxide PSD increments of 512 ug/m^3 and 91 ug/m^3, respectively. Carbon monoxide and nitrogen oxides were not modeled to determine air quality impacts.

The impacts of the nearby power plant expansion would be addressed in a separate air permit application. It is not expected that there would be a significant cumulative air quality impact from these two projects.

5.3.4.3 Visibility

A level 1 visibility screening analysis (see Appendix E) showed that there will be no visibility impacts from the project on any Class I area.

5.3.4.4 Summary

In summary, during project construction, operation and reclamation, maximum predicted short- and long-term concentrations of particulate matter and sulfur dioxide, when added to background levels or compared to PSD increments, would not exceed any state or federal ambient air quality standards in the Kenai, Anchorage, or Tyonek areas or within the undeveloped area outside of Diamond Chuitna Project lease areas. Based on the modeled emissions, it is not anticipated that any short- or long-term ozone, carbon monoxide, or nitrogen oxide ambient air quality standards would be exceeded as a result of this project.

It should be noted that this analysis has addressed major air quality issues and concerns. Particulate matter dispersion modeling and air emissions control technology aspects and concerns will be further addressed in an application for a permit to operate from the Alaska Department of Environmental Conservation.

Table 5-21

AIR QUALITY MODELING ANALYSIS
SULFUR DIOXIDE CONCENTRATIONS

Averaging Period	Peak Project Concentration (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	Ambient Standard (ug/m^3)
3-hour	122	35.0(b)	157.0	1300
24-hour	21	7.0(b)	28.0	365
Annual	NA(a)	0.3(b)	ND(d)	80

(a) Not available.

(b) Second highest value observed at Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981, to May 31, 1982, (Radian 1982).

(c) Annual average geometric mean concentration recorded at the Tesoro Petroleum Corporation air monitoring station near Kenai, Alaska from June 1, 1981, to May 31, 1982, (Radian 1982).

(d) Not determined.

5.3.5 Noise Impacts

The Diamond Chuitna Coal Project would be located in a relatively isolated area. Typical natural noise levels in areas similar to the Beluga region range from 15 to 45 dB(A), which is considered quiet. Natural noise levels up to 65 dB(A) may be associated with storms and wildlife activities. Coastal areas would have higher noise levels due to strong winds and wave and ice movements.

The mine site would be one of the two areas with the highest noise levels during project operations. Major noise sources in the mine area would include infrequent blasting, bulldozers, front-end loaders, draglines, haul trucks, and crushing equipment. Table 5-22 shows typical noise levels associated with mining equipment. Blasting sound pressure levels are normally thought of as relatively loud noises. However, blasting noise propagates in lower frequencies somewhat like a thunderclap. Low frequency sound of this type would usually be tolerable since it would occur infrequently. The other mine site sound sources would probably combine to a sound level of 100 dB(A) at 15 m (50 ft).

Human receptors in the project vicinity would include project workers and occasional recreational or subsistence hunters and fishermen. The village of Tyonek would be a minimum of 14.4 km (9 mi) from the mine site and it is - unlikely that project-generated noise (except possibly occasional blasting) would be audible to Tyonek residents. Noise-related impacts to wildlife are discussed in Section 5.3.1.5.

5.3.6 Socioeconomic Impacts

5.3.6.1 Anchorage and Central Kenai Peninsula

Socioeconomic impacts in Anchorage and the Central Kenai Peninsula would arise due to employment and income generated by the project. The project development schedule calls for a three-year construction period. Construction would begin in the spring with the workforce expected to peak at 1,300 workers by approximately October of the second year (Fig. 2-15). Once the peak of construction is past, employment at the site would decline for the remaining year of construction, then climb during mine operation over a four-year period from about 514 to 848 during the first year of full-scale operation. Air transportation to the site would be provided by the applicant from Anchorage and Kenai.

Table 5-22

ESTIMATED SOUND LEVELS GENERATED BY MINE AREA EQUIPMENT AND FACILITIES

Sound Source	Sound Pressure Level[1] dB(A)
Blasting	170 @ 91 m (300 ft)
Bulldozers	87 @ 15 m (50 ft)
Front-end Loaders	90 @ 15 m (50 ft)
Haul Trucks	90 @ 15 m (50 ft)
Primary/Secondary Crushers	95 @ 15 m (50 ft)
Utility Vehicles	80 @ 15 m (50 ft)
Aircraft Operations	95 @ 15 m (50 ft)
Conveyor	78 @ 10 m (33 ft)
For Comparison:	
OSHA Regulation (15 min. exposure)	115 (max. allowable)
Jackhammer	95 @ 15 m (50 ft)
OSHA Regulation (8 hr. exposure)	90 @ ear
Automobile (100 km/hr [62 mi/hr])	71 @ 15 m (50 ft)
Typical Outdoor Noise (wind, rain, birds)	40 @ 15 m (50 ft)
Soft Whisper	35 @ 2 m (6 ft)

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[1] The sound pressure level in decibels (Db) corresponding to a sound pressure (P) is compared to a reference level of 20 micropascals. Sound pressures for various frequencies of noise are weighted by factors (A weights) which account for the response of the human ear. The sound pressure level is dB(A) = 20 Log10 (P/20).

The primary skills required during construction would be equipment operators, laborers, and various structural construction trades. Mine operation would require primarily equipment operators, mechanics, electricians, plumbers, administrative personnel, and service workers for the worker housing facilities. These skills are in plentiful supply in the available labor force in Anchorage and the Kenai Peninsula Borough. The applicant plans to hire as much of the construction and operation labor force locally as possible, with the possible exception of several specialized equipment operators since persons with these skills are rare in Alaska.

At full production, all of the project alternatives would employ the same number of people. Therefore, socioeconomic impacts in Anchorage and the Central Kenai Peninsula, described below, apply to all action alternatives under the full production scenario.

A recent Kenai Peninsula Borough survey indicated that about 80 percent of the oil and gas employees working the Upper Cook Inlet fields live in the Kenai Peninsula Borough and the remainder live in Anchorage (McIlhargy 1985). However, company-sponsored transportation of these workers to Cook Inlet work sites, is provided only from Kenai. The applicant's local hire policy and probable provision of transportation from both Anchorage and Kenai would likely result in a higher proportion of worker residence in Anchorage. A 50-50 distribution of worker residence between Anchorage and the Kenai Peninsula Borough during both mine construction and operation is assumed for purposes of this analysis.

Impacts on Anchorage

Relative to Anchorage's 116,442 jobs in 1984, the estimated direct increase of approximately 650 jobs during the construction period and 424 jobs during full-scale mine operation would cause proportionally small but beneficial impacts to Anchorage's socioeconomy. Impacts on Anchorage's population would be correspondingly beneficial, but not noticeable given the level of baseline socioeconomic activity in Anchorage.

Impacts on the Central Kenai Peninsula

The effect of the 650 construction and 424 mine operation jobs would be more noticeable in the Central Kenai Peninsula (CKP) than in Anchorage. The most noticeable impacts would be those occurring due to mine operation. Operation-phase impacts are discussed below followed by a summary of construction impacts.

Mine Operation

Although the project's entire operation work force requirement would be directly filled by the locally available labor supply, indirect impacts could occur. A common experience in Alaska, as in other areas where substantial new employment has been created, is an influx of persons seeking work. If this occurs, the impact of the project could be to substantially increase employment in the CKP, but not to noticeably change unemployment rates. To place a reasonable maximum limit on population growth due to the project, the following analysis assumes that immigration would occur in proportion to the employment increase. The actual impact of the project would probably be lower, particularly if statewide efforts to discourage potential migrants without jobs from moving to the state are successful.

As the mine's employees spend their paychecks on local goods and services, employment in the service sectors of the CKP economy would increase. Thus, the ultimate increase in employment would be a multiple of the direct increase of 424 operation-phase jobs for local workers generated at the mine itself. Based on analysis of the Soldotna and Kenai Census Areas' place-of-work employment distribution by economic sector (Miller 1985), there are approximately 0.5 service-sector jobs for every job that brings income into the region. Therefore, the 424 jobs taken at the mine by CKP residents can be expected to produce a total increment of about 640 jobs. Most of the 216 service-sector jobs would be located in the City of Kenai, the area's main center of employment.

The spread of knowledge of substantial new employment in the Borough could attract job-seekers, some of whom may compete with Borough residents for jobs both at the mine and at other CKP businesses. If this occurs, a high-side population increase attributable to the project, including the effects of the employment multiplier, can be estimated as equiproportional to the increase in employment, or about 4 percent in the CKP and up to 17 percent in Kenai if all service-sector jobs and immigrants locate in the City (and bring families approximately equal in size to the area's existing families).

Because any inmigrating job-seekers could be expected to live in both Kenai and the surrounding area and some of the 215 new jobs would also be located outside of Kenai, a more reasonable estimated increase to the City's population would be approximately 10 percent by full mine operation. Thus, the maximum population increase to the City of Kenai is estimated at 900 persons. For the CKP, the corresponding population increase would be 1,600 (including the 900-person increase to the City of Kenai). The proportional increase would decline over time as the local socioeconomy grows due to other economic developments.

The population increases described above could have some impact on city planning but should not unduly strain public services and facilities available in the City of Kenai. The City has adequate excess capacity in its public facilities and services to accommodate a current increase in demand of 10 percent. Given the minimum of two years required after the start of construction before appreciable population increases are likely to be felt and the gradual increase in mine operations scale thereafter, there would be adequate time for the City to plan for any service improvement programs that may be required.

If a student-to-population ratio of one-third (the approximate 1985 local average) applies to the 900 persons expected to move to Kenai due to mine operation up to 300 students would be added to the Kenai schools. Several new schools are being completed in the Kenai area and it is expected that an increase in students due to the mine project could be accommodated.

The population increase attributable to the project (up to 1,600 persons) would also increase demand for health services. If a requirement of 5 beds per 1000 population (Nichols 1985) applies, 8 new beds would be required at Central Peninsula General Hospital in Soldotna.

The existing capacity of Kenai's water system is adequate to service demand well into the 1990s. If water demand growth is equal to annual projected without-project population growth of 5 percent, peak daily demand in 1992 will be 1.7 million gallons per day (mgd). If the current per capita peak daily demand of 343 gallons per day applies to the 900-person population impact of mine operation on Kenai, the peak water demand increase would be about 310,000 gallons per day. The total peak demand of 2.0 mgd would be well below the system's current pumping capacity of 2.9 mgd.

Kenai's sewage treatment system, however, will require capacity improvements by the early 1990s without the project. The population increase attributable to mine operation will require system improvement about two years earlier.

Kenai's police and fire protection services may also require improvement due to mine operation. At the 1985 population-to-officer ratio of 475:1, the population increase of 900 would require two new positions in the police department. Fire protection capacity may also require upgrading to serve the 20 percent project-related population increase. The type of capacity improvement would depend upon the location of the increased population and the type of housing and commercial facilities built in response to the increased population.

The maximum population increases to the remaining communities in the CKP would average under 3 percent by full production and would also be gradual over the operations phase-in period. The small population increase occurring over time would not be expected to strain public facilities and services in this larger area.

Mine Construction

Project construction would cause short-term increases similar to, but probably of much lower magnitude than, those described above for mine operation. Although the direct increase to the employed work force in the CKP would be higher (at about 650) than during operation, the short peak construction period would likely limit induced service-sector employment to a negligible level. Furthermore, the short peak period would probably lower the level of inmigration by persons who may move to the area to attempt to obtain construction jobs.

5.3.6.2 Tyonek

For purposes of analysis, the potential socioeconomic effects on the village of Tyonek are classified into three categories: 1) effects on local employment, 2) effects on community population and infrastructure including cumulative socioeconomic effects, and 3) social and cultural effects.

Effect on Local Employment

Unemployment and underemployment are chronic problems for residents of rural Alaskan villages and Tyonek is no exception. A lack of a basic year-round industry is the most pervasive reason for this economic problem. This absence of a solid economic foundation is often compounded by other problems when jobs do become available. For example, unskilled local labor, work schedules incompatible with subsistence and other traditional activities, lack of effective training programs, and cultural differences between Native workers and (usually) white employers contribute to the low levels of local employment in many Alaskan villages. Even in rural areas where industrial or natural resource development has occurred, employment of local residents frequently falls short of expectations. Low employment levels of Tyonek residents at the KLM timber harvesting operation and chip mill in the late 1970s provide an illustration of this problem. This case example is used to show that large-scale resource development projects are not necessarily a panacea to local unemployment problems and that the barriers preventing expanded employment opportunities for rural residents are substantial and must be approached with creative planning and implementation measures by all parties.

Table 2-3 presented projected employment levels associated with the Diamond Chuitna Coal Project. These employment figures refer to mining-phase employment only and do not include employment levels for project construction. Of the projected 848 permanent employees, approximately 218 would be heavy equipment operators, 125 would be light equipment and truck operators, 289 would be mechanics and skilled maintenance personnel, 110 would be involved in life support services (such as cooks), and 106 would be in administrative positions (Table 5-23). Table 5-23 also presents the skills present in Tyonek's current labor force. These skills match, to a considerable degree, the skills required by Diamond Alaska for operation of the coal mine. The potential will therefore exist for Diamond Alaska to use workers from Tyonek in a variety of capacities in both construction and operation of the mine and related facilities. Hence, the coal project has the potential to alleviate Tyonek's local unemployment problem.

In summary, the Diamond Alaska Coal Project would boost local employment opportunities but in the long term would not necessarily solve the unemployment problem in Tyonek. The success of the effort to maintain a high level of local employment would depend on the effectiveness of job training programs, the individual performance of Tyonek workers, Tyonek residents' adaptation to coal mining jobs, successful integration of mine employment with subsistence activities and agreements between Diamond Alaska and the village of Tyonek.

Effects on Community Population and Infrastructure

Because Diamond Alaska plans to house workers in a "single status" housing facility, short-term impacts on Tyonek's population level, infrastructure, and community services would be minimized. Worker needs, such as food, waste disposal, indoor recreation, and others would be provided by the applicant at the housing facility. Impacts on community population and infrastructure for other communities, such as Kenai and Anchorage, were discussed earlier.

Table 5-23

MINING PHASE EMPLOYMENT BY OCCUPATIONAL GROUP

Occupational Group	Mine Employees[1]	Number in Tyonek[2]
Heavy Equipment Operators	218	12
Light Equipment and Truck Operators	125	25
Mechanics and Skilled Maintenance	289	13
Life Support Personnel (e.g., cooks, housekeepers, etc.)	110	undetermined
Administrative	106	13
Total	848	

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[1] Diamond Alaska Coal Company

[2] Based on a 1983 survey by Darbyshire and Associates (1984) that identified a total Tyonek work force of 145 people. These figures include the number of people indicating skill in each general occupational group.

Tyonek's population remained relatively stable throughout the 1970s due, in part, to migration out of the village (see Section 4.7.2.1). One reason for this trend is the lack of local employment opportunities. If the coal project employs a high number of Tyonek residents, then villagers may be less likely to leave the community to seek work. In addition, former Tyonek residents may return to the village to take advantage of increased employment opportunities. Although the population increase due to decreased outmigration or past residents returning to the village would place additional demands on local infrastructure and services (i.e., the school, medical services, and other community facilities), these people would be absorbed relatively easily by the community and assimilated into the social fabric because of familiarity and strong kinship ties with Tyonek. This would not be the case, however, if there were an influx of people unfamiliar with the village, its residents, and the local culture.

Even though the proposed project has been designed to minimize the number of permanent residents and demand for community services on the west side of Cook Inlet, long-term population growth in the area seems inevitable. Although the proposed coal project would not be the sole cause of such growth, it would likely be a major contributing factor (i.e., 1,300 workers in the area by year two of the project would be a major source of demographic change). Additional permanent residents could come from two sources. First, the stimulation of the local economy would provide opportunities for secondary economic expansion and entrepreneurial activity and would make the area more attractive to potential residents. This trend is already occurring at Beluga where a grocery has opened to meet the needs of a growing community and at Granite Point where a local business provides lodging accommodations and a restaurant.

Second, mine workers facing a long-term employment future could decide to purchase private land in Beluga or at Granite Point and move their families to the area. Lands designated for settlement near Congahbuna and Viapan lakes have been identified in the Susitna Area Plan (ADNR 1984). If demand for homesites in the area increases, these lands could be made available for settlement.

The impacts of long-term regional population growth could include increased demand for community services, including pressure to enroll children in the KPB school in Tyonek, increased pressure for a year-round road connection to Anchorage, and erosion of the "quality of life" in Tyonek and gradual dilution of Tanaina culture as more and more non-Tyoneks reside in the area.

Social and Cultural Effects

Sociocultural impacts are difficult to accurately predict for two reasons. First, the effects tend to be caused by the project in its entirety, including cumulative effects, rather than by discrete components. Hence, causal relationships between a given project and a resulting social or cultural effect are extremely difficult to identify. Second, social and cultural impacts are determined as much by the values and attitudes of the affected population as by design of the proposed project. The response capacity or adaptive ability of small, rural communities is typically low because of the magnitude of resource development projects relative to the size of the community, the lack of an effective voice in decisions regarding development of nearby lands, and the rapid rate of change that these communities are already experiencing.

The social and cultural effects of the proposed project would "largely depend upon the question of whether the changes will allow greater opportunities to realize ... values and goals or whether they will constrain and restrict the realization of these" values and goals (Braund and Behnke 1980). The cultural impacts would also depend on the ability of Tyonek residents to effectively adapt to changing socioeconomic conditions.

Four major issues or current concerns emerged during discussions in Tyonek. These issues can be viewed as articulations or relevant aspects of Tyonek's value system and include:

- A need for expanded local employment opportunities
- Increased voice in, and control over, decisions that affect the quality of life in the village and the lands and resources used by village residents
- Maintenance of the rural village quality of life traditionally important to local residents
- Maintenance of a subsistence-based livelihood and protection of the wildlife and environment that provide for these subsistence pursuits

These four issues and their relationship to the proposed project are discussed below.

The project has the potential to provide considerable employment opportunities for Tyonek residents and hence alleviate a major problem in the community. The project may also have positive social effects stimulated by the higher incomes that could accompany coal development. Social benefits could include a reduction in poverty-related stress as well as the symptoms that accompany this stress, i.e., boredom, depression, and alcohol abuse. The degree to which these positive benefits occur depend entirely on how successful the applicant and the residents of Tyonek are in maintaining a high level of local employment.

The proposed project would have little effect on governing control over land that is currently owned or governed by TNC or the Native Village of Tyonek (i.e., they already can legally control access onto their land, if necessary). These lands, however, make up relatively little of Tyonek residents' customary use area which includes lands owned by the State, CIRI, KPB, and private individuals in addition to TNC lands. Tyonek's voice in decisions related to the use of lands outside of their legal control would diminish as more and more outsiders work, recreate, and potentially choose to reside in the area. These activities would become a source of increasing conflict and local concern. For the first time in their long history, Tyonek residents would be a minority in their own region.

The Diamond Chuitna Coal Project has incorporated features that would tend to reduce adverse social and cultural disruption to Tyonek. Most importantly, the housing facility has been designed to accommodate only single workers rather than providing for permanent settlement by workers and their families and development of the infrastructure and services to support a self-contained town. In addition, the proposed transportation corridors and port sites are not located on Tyonek's land (though the southern corridor is in an area used frequently for subsistence harvests by Tyonek residents) and they are far enough away from the village to provide a "land buffer".

However, even though Tyonek can protect itself from physical intrusion of outsiders onto TNC or NVT controlled lands, protection of village culture or lifestyle is more difficult. Increased stress and social conflict would occur as a result of interaction between villagers and workers with vastly differing attitudes and values, resentment of the presence of coal mining activity by some villagers, conflicts between village subsistence hunters and fishermen and non-Native sportsmen, potential erosion of Tyonek's subsistence resource base, and potentially low long-term employment of Tyonek residents at the mine.

Finally, subsistence is perhaps the strongest and most important element of Tyonek's social and cultural value system. Maintenance of a subsistence-based livelihood is essential to prevent erosion of this value system. The effects of the proposed coal mining project on subsistence resource use is considered in Section 5.3.7.

5.3.7 Effect on Subsistence Resource Harvest

Potential effects of mine construction and operation on subsistence resource availability and harvest considered in this section are: effects on access to, and use of, customary use areas and changes in fish and wildlife abundance.

5.3.7.1 Effects on Access to and Use of Customary Use Areas

Tyonek residents currently use a 1,942 km^2 (750 mi^2) area between the Chuitna River to the north and the McArthur River to the south and approximately 216 km (135 mi) of coastline from the mouth of the Susitna River to Tuxedni Bay (Fall et al. 1984). The proposed mine and lease area are currently used relatively little by Tyonek residents. Although residents have historically used this area, its current use is limited to occasional trapping and moose hunting during hunting seasons when snow depths are insufficient to force moose to lower elevations (Foster 1985; Fall et al. 1984).

5.3.7.2 Effects of Changes in Fish and Wildlife Abundance

Subsistence resource harvest would also be affected by changes in fish and wildlife populations. Population changes would occur if there were changes in the amount of limiting habitat for important subsistence species. Habitat changes could be due to direct habitat loss (for example, by removal of vegetation) or due to indirect habitat loss (such as displacement of game by noise and general activity). In addition, there could be gains in total habitat following reclamation depending on plant species used for revegetation and success of reclamation.

From the best information available, it seems that there would be some direct moose habitat loss, at least until reclamation efforts are successful. Moose adapt well to human activity and disturbance. Hence, indirect habitat loss due to noise and disturbance is not expected to seriously affect moose populations or distribution. Adverse impacts to subsistence hunting would be directly related to the effect of the project on moose abundance. Therefore, a monitoring program has been established by ADF&G to assess moose population trends. This will allow moose management plans to be adjusted as needed to protect subsistence resources (ASMCRA permit stipulation 10).

A net loss of salmon spawning and rearing habitat in the Chuitna River drainage would occur as a result of the Diamond Chuitna project. Late in the mine life, during the years of maximum impact, chinook salmon escapement (the primary subsistence species) could be reduced by up to 30 percent per year (Table 5-11). Since salmon comprise 71 percent of the edible weight of subsistence resources harvested and approximately 17 percent of total village employment income (Section 4.7.2.2), a decline in salmon returns could cause a significant adverse impact to Tyonek's subsistence and commercial fisheries. The proportion of salmon caught in the marine subsistence fishery that originate in the Chuitna River cannot be determined on the basis of existing data. The location of the fishery suggests that Chuitna River fish would be caught in substantial numbers; however, maximum escapement to the Chuitna is a small fraction (less than 5 percent) of the Susitna River runs which undoubtedly contribute the majority of the Tyonek harvest. Reduction in available fish as a result of mine impacts would be expected to have a small, adverse impact on the fishery that would be difficult to detect within the context of natural variation of fish numbers.

5.3.8 Impacts to Visual Resources

In general, visual resource impacts would be limited by the low use level of the area within the viewshed of the project components. The project components most visible to viewing populations from the ground or water would be the port and conveyor system. All facilities would be readily visible from the air. In addition, the increased level of activity, including air and ship traffic at the site would affect visual resources.

Current use of the project area is limited to subsistence and recreational use by Tyonek residents and fishing and hunting by non-Natives. Based on reported moose and bear harvest locations (ERT 1984f), hunting is common to the east, northeast, and south of the project area but is rare within the project area itself. Fishing is focused on the Chuitna River and Lone Creek to the east of the project area and Nikolai Creek to the south. As noted in Section 4.10, up to 5,000 man-days are spent in the local sport fishery, not including subsistence. This level of effort would probably grow substantially over the next decade without the project since local guides plan to expand their services. Visual impacts on hunters and fishermen may therefore be important in terms of viewer attitude, but visibility of the project from primary hunting and fishing areas would be very limited.

Except for the overburden stockpile and offshore port facilities, project facilities would not be visible from most ground-level vantage points over 1.6 km (1 mi) away due to visual screening offered by vegetation and topography and the low heights of structures. The overall visual impact of the proposed project is assessed as low to moderate due to: 1) the low use of the area for purposes other than hunting and fishing (primarily recreation use by Tyonek residents and commercial fishing and oil and gas extraction in the Cook Inlet in the port vicinity); 2) low visibility of the project from ground-based locations; and 3) the project area's medium-high scenic quality rating (Section 4.8).

5.3.9 Impacts to Recreational Resources

Direct adverse impacts to hunting arising from the approximately 2,051 ha (5,068 ac) of land disturbed by the mine and mine service area would be minor due to the low level of use of the project area by hunters. Effects on hunting east and south of the project area would likely be minimal. Most mine facilities would be located upstream from portions of the Chuitna drainage that are used by sport fishermen. Therefore, direct physical disruption of popularly fished stream reaches within the project area by construction and operation of project facilities would be minor.

Reductions in some fish populations would be expected. The worst case analysis described in Section 5.1.3.2 suggests that populations of popular sport species (chinook and coho salmon) could be substantially reduced in the Chuitna River during the years of maximum impact late in mine life. This loss would reduce harvest rates and thereby lower the quality of the project area for sport fishing during the years of impact.

High turbidity resulting from construction or mine operation could have an adverse effect on the aesthetic and recreational enjoyment of streams. Salmon or trout fishing, especially fly fishing, is not feasible in waters where turbidity exceeds 20 to 25 NTU. Any increased duration of turbid conditions in the Chuitna River downstream of Lone Creek might temporarily reduce the effectiveness of sport fishing efforts in the area.

Indirect impacts would arise due to this alternative's effects on visual resources. The visual presence of the project would reduce the quality of the "wilderness experience" for hunters and fishermen who view project facilities during flights into the area and from the ground. Noise impacts would similarly reduce the quality of the recreational experience. These latter impacts would probably be significant given the high quality experience that the area now provides.

5.3.10 Impacts to Cultural Resources

The impacts of the mine and mine service area on cultural resources in the project area would be minimal. The baseline cultural resource site survey (Gerlach and Lobdell 1983) disclosed no archaeological sites in the area of the mine and mine facilities. The possibility of disturbing cultural resources outside the construction zone as a result of increased human presence in the region is expected to be slight given the topography, vegetation, and small number of known sites.

5.3.11 Regional Use

Most of the areas in the Beluga Region which are likely to be developed in the future for coal, timber, hard rock minerals, or hydropower are located to the west of the proposed mine site. It is unlikely that the mine itself and the mine service facilities would be easily used by or benefit regional development.

5.3.12 Technical Feasibility

Adequate technology exists to develop the mine and mine service area as proposed.

5.4 APPLICANT'S PROPOSED PROJECT

As described in Chapter 2.0, the applicant's proposed project consists of two possible transportation corridor/ port site options: a southern transportation corridor leading to a Granite Point port site or a northern transportation corridor leading to a Ladd port site (Fig. 2-1). Project alternatives incorporating either of these options could be selected by the applicant depending on economic and other factors.

5.4.1 Southern Transportation Corridor; Granite Point Port Site

5.4.1.1 Impacts to Terrestrial Environment

Physiography, Geology, and Soils

The major construction and operation impacts of the southern/Granite Point alternative related to physiography, geology, and soils would result from gravel extraction and placement. Gravel placement and extraction would occur during construction and maintenance of the road, drainage structures, and facilities. The coal transportation system and roadway component consists of the main haul road, overland conveyor, the conveyor access/service road, and transfer facilities at each end of the overland conveyor. Approximately 1.9 million m^3 (2.5 million yd^3) of material would be required for construction of this component.

The port facilities component consists of onshore and offshore facilities. The onshore facilities would be located on an elevated pad consisting of approximately 2.0 million m^3 (2.6 million yd^3) of material.

Construction of the coal transportation system and adjacent haul road would disturb about 33 ha (82 ac) of primarily Strandline sandy loam soils on a 35 m (116 ft) width of the right-of-way although 16 ha (40 ac) of Starichkof-Chichantna peats and 10 ac (25 ac) of Starichkof peats would also be disturbed. Onshore port facilities at Granite Point would require approximately 97 ha (242.4 ac) of primarily Starichkof peat soils.

Long-term disturbance of soils is expected to occur as a result of construction of the coal transportation system and the haul road. Blading for the roadway and for the footings of the conveyor system would irreversibly disturb soils. An irreversible disturbance is construed as one having no forseeable restoration within 100 years. The longevity of the restoration is dictated by the soil-forming rate which in the regional climate is extremely slow (Douglas and Tedrow 1959; Brady 1974).

Vegetation

A road approximately 18.5 km (11.6 mi) long and 35 m (116 ft) wide would be cleared for the coal transportation system. Also, an 2.4 m (8 ft) wide conveyor with a 4.6 m (15 ft) wide adjacent access road would be constructed. This would mean elimination of 46 ha (115 ac) of primarily mixed spruce-birch woodland. A total of 15 ha (38 ac) of alder and 16 ha (40 ac) of sphagnum-shrub bog would also be eliminated by construction clearing in this corridor.

Construction of onshore facilities at the Granite Point port site would disturb or eliminate a total of 95.1 ha (237.7 ac) of primarily open low shrub scrub/sweetgale-grass fen. An additional 16.8 ha (42.1 ac) of open mixed spruce, birch forest and 7.8 ha (19.6 ac) of needleleaf woodland/black spruce forest would also be lost during construction. Approximately 1.2 ha (3 ac) of open water habitat would also be eliminated.

In addition to direct disturbance from clearing activities, the potential also exists for vegetation to be indirectly affected during operation. An increase in foot traffic, off-road vehicle use, vehicle road dust, and coal dust emissions would be expected during mining and coal transportation. Studies of gravel roads on Alaska's north slope suggest that dust is deposited in a "shadow" tens or hundreds of meters from roads depending on wind conditions (Everett 1979). Roadway and coal dust could reduce plant growth rates near the mine, mine service area, and transportation corridors by physically impeding leaf gas exchange or by bioaccumulation of materials in leaf tissue (Olson 1982; Smith 1981). Lichens would be especially sensitive to such accumulation (Hale 1981), but conifers could also be affected if concentrations are great enough (Treshow 1970). Also, such fallout can cause reduction in soil acidity which may alter plant composition in the vicinity of roads. Acid-loving plants such as mosses could become less abundant over the long-term and grasses and sedges more abundant. The effects would be noticeable only adjacent to roadways within the dust shadow and would not be significant on a regional basis. Dust control measures would minimize adverse impacts. Coal dust would be deposited on vegetation within very limited areas immediately below the conveyor and adjacent to transfer facilities. Transfer facilities would be covered and the conveyor would be protected on one side by a windshield, thus adverse impacts to vegetation are expected to be insignificant.

Damage to vegetation could also occur from fuel and chemical spills. The degree of impact would depend on the amount of the spill, the time of the year, type of community, and type of action required for the cleanup (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or those occurring in winter. Spill contingency plans would help to prevent or minimize damage.

Long-term adverse impacts on vegetation would occur in areas that are cleared and used continuously during mining. Reclamation operations could not be implemented until the conveyor and transportation corridor and port loading facilities were dismantled. Reestablishment of vegetation would not occur until 10 to 15 years after project completion. However, because the plant communities affected by construction of these facilities are well represented in the area, impacts to the vegetative resource are not expected to be significant.

- Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the southern transportation corridor or the Granite Point port site.

Wetlands

Approximately 9 ha (22 ac) of wetlands would be directly disturbed by the southern transportation corridor. The majority, i.e., 43 ha (10.8 ac), would be classified as palustrine - scrub/shrub broad-leaved deciduous/emergent narrow-leaved persistent. Material sites would disturb 4 ha (10 ac) of wetlands and the Granite Point port facility would adversely affect 79.5 ha (198.8 ac) of wetlands (Table 5-2).

Table 5-2 shows the types of wetlands disturbed for each facility and compares the alternative corridors. The surface area of wetland affected by the southern/Granite Point alternative is greater than the eastern/Ladd alternative and the northern/Ladd alternative because of the substantial wetland affected by the Granite Point port site.

In addition to direct adverse impacts, wetland structure and function would be altered adjacent to project facilities. Indirect impacts would include blockage of natural drainage patterns and disturbance of wetland inhabitants. Wetland values are discussed further in Section 4.3.2.3.

Wildlife

Impacts to wildlife include direct habitat loss, indirect habitat loss (inability to use a habitat), effects on animal movements, and construction impacts.

- Southern Transportation Corridor

Construction of the southern corridor, including the conveyor and access/haul road, would cause a direct habitat loss of approximately 69 ha (171 ac). This loss would be significant only on a local basis for song bird, waterfowl, shorebird, small mammal, and furbearer populations and would not be significant even on a local basis for other bird and mammal species.

Indirect habitat loss for song bird, shorebird, waterfowl, small mammal, and most smaller furbearer populations, including beaver, could be significant on a local basis, but these species would likely adapt (to varying degrees) to the presence of the conveyor and access/haul road (Univ. Maine 1983).

The lone bald eagle nest tree within the southern corridor (Fig. 4-4) is located between the conveyor and the haul road. These facilities were aligned specifically to avoid the nest tree and it would be at least 457 m (1,500 ft) from both rights-of-way. No direct project-related activities would occur within that distance. Normal project activities would likely not cause disturbance which would affect breeding success of eagles using this site during the operational phase of the project, including the two-year initial coal trucking period (Hodges 1985).

Two trumpeter swan nest sites are located close to the proposed conveyor alignment. The site in the bottom of the Chuitna River canyon (Fig. 4-4) would be located about 305 m (1,000 ft) east and 52 m (170 ft) vertically below the conveyor as it crosses the river by suspension cables and would be about 543 m (1,781 ft) northwest of the access/haul road at its closest approach. No direct project-related activities would occur within that distance. In Alaska, however, swans very seldom nest within viewing distance of roads (King 1985). This site would be screened from much of the access/haul road by vegetation, but the road would be visible on the north side of the canyon. Historical evidence tends to indicate this nest site has not been regularly and successfully used (ERT 1984f). Swans are very aware of objects above them (King 1985) and would, therefore, be aware of the suspended conveyor. The limited historical use of the site, coupled with the presence of the road and suspended conveyor, would likely prevent use of the site for nesting during the life of the project.

The second swan nest site is located approximately 381 m (1,250 ft) west of the conveyor alignment in the vicinity of Congahbuna Lake (Fig. 4-2). The conveyor and access/haul road alignment would be further away from the site than the existing network of logging roads. Therefore, negative impacts from the project would probably add very little to those that exist at present.

Although no specific sandhill crane breeding has been reported within the southern transportation corridor, breeding and foraging habitat may exist in the southern portion of the corridor just north of the Granite Point port site. Cranes have been frequently sighted in the vicinity of the southern portion of the corridor. Operation of a conveyor and access/haul road through this area would likely discourage use of the area for nesting and possibly for foraging.

Moose and black bears would likely avoid the corridor during operation to some degree until they adapted to activities within it. This avoidance would be significant only on a local basis and long-term indirect habitat loss for these species would be minimal. Brown bears would likely avoid activities in the corridor to a much greater degree, perhaps causing a regional impact if such avoidance significantly interfered with movements across the corridor.

Assuming proper use of snow blowers to prevent high snow berms, the access/haul road would not pose a physical barrier to most animals wanting to move across it. During the first two years of operation, however, noise and other disturbance associated with truck traffic hauling coal from the mine to the port would discourage some animals from crossing or at least substantially reduce or delay normal movements across the corridor. Some moose may be lost due to collisions with vehicles.

Since the conveyor would be elevated a minimum of 0.6 m (2 ft) above ground level, neither the mine area conveyor nor the main overland conveyor should pose a physical barrier to birds and smaller mammals crossing the corridor. Crossings capable of passing large mammals would exist in at least four locations along the mine area conveyor and in at least twenty locations along the overland conveyor (Fig. 2-7). At these points, the conveyor would be either buried or elevated a minimum of 2.4 m (8 ft) above ground level.

Moose crossing studies of the trans-Alaska pipeline system show that moose can cross under the pipeline at heights of 1.5 m (5 ft) or greater in winter (Eide and Miller 1979; Sopuck and Vernam 1984; Van Ballenberghe 1978). Eide and Miller (1979) found no correlation between pipe heights over 1.5 m (5 ft) selected by moose and snow depths under or near the pipe at depths up to 66 cm (26 in). Snow depths in the vicinity of the mine service area can reach 102 cm (40 in) or greater. Such depths could affect moose selection of conveyor crossing heights; however, the minimum 2.4 m (8 ft) heights at the crossings should provide adequate opportunity to pass moose even in deep snow.

When first encountering the conveyor, large mammals would have to move parallel to it until reaching a crossing. For the mine area conveyor, the average center-to-center distance between crossings would be approximately 849 m (928 yd), with a maximum distance between crossings of 960 m (1,050 yd). For the main overland conveyor, the respective values would be 880 m (962 yd) and 2,006 m (2,193 yd).

The conveyor would emit more or less continuous noise with levels probably in the range of 75 to 79 dba at 10 meters (33 ft). This noise level would be similar to the level associated with vehicle traffic on a public highway, but more constant. Noise levels would be substantially lower at buried wildlife crossings. It is anticipated that moose and black bear, when first encountering the conveyor, might shy away but that animals inhabiting the area would readily adapt to the constant noise. Noise would probably not prevent moose and black bears from crossing the conveyor at crossing areas. As mentioned above, brown bears are more sensitive to noise and activity as a whole and might be discouraged from approaching and crossing the conveyor.

To summarize, the movements of moose and black bears would be locally altered by the presence of impassible portions of the conveyor system, but it is expected that regional movements would not be significantly affected because of the availability of crossing areas. Brown bear movements and access to traditional habitats would likely be adversely affected with possible regional significance.

Noise and disturbance associated with construction of the access/haul road and conveyor would have relatively little impact upon song bird, shorebird, and small mammal populations. Waterfowl and raptor nests near the alignments, however, might be abandoned if construction activities occurred nearby during the critical period from mating through the first few weeks after hatching. Bald eagles using the nest on the north side of the Chuitna River (Fig. 4-4) would be susceptible to disturbance if construction activities occurred within 100 m (110 yd) or if blasting occurred within 805 m (880 yd) between March 1 and July 1.

Excavation of gravel and other fill materials for use in project construction would cause an estimated maximum direct habitat loss of approximately 202 ha (500 ac)(Fig. 2-16). This would be significant only on a local basis for songbirds and small mammals, and possibly for waterfowl and shorebirds at site 8. These local adverse impacts would be temporary because the gravel pits would be rehabilitated when they were no longer needed. Indirect habitat loss and effects on movements for most species would be locally significant only during construction periods when animals would avoid the areas because of human activities.

- Port Site

Direct habitat loss from construction of the onshore port facility at Granite Point would be approximately 80 ha (198 ac). For song bird, shorebird, cranes, waterfowl (including swans), and small mammal populations, this loss would be significant on only a local basis. For other species, including moose, this loss would not be significant, even on a local basis. Since the port site would be located within poor to moderate value winter range and moderately important spring, summer, and fall moose range, direct habitat loss for moose would not be significant.

Indirect habitat loss would not be significant except for moose and black bear as most species would adapt to the presence of the facility (Univ. Maine 1983). For moose and black bear, indirect habitat loss initially could be locally significant, but these species would likely acclimate to some extent with time to the noise and activities. Brown bears would not be significantly affected since they are very seldom found in this area.

The onshore port facility itself would not have a significant effect on animal movements, but it would contribute to some movement interference because of its location at the southern terminus of the conveyor. Animals would be able to move around the facility by crossing the conveyor at designated animal crossings, including one immediately north of the port site (Fig. 2-7).

Construction activities at the port, aside from direct habitat loss, would have relatively little impact upon birds and small mammals. However, construction would displace moose and black bears to a greater ~~degree~~ than during operation of the facility and might be of local significance.

- Habitat Evaluation

The results of the habitat evaluation study performed for this EIS (Appendix A) are summarized for the various ancillary facilities in Table 5-24. The southern transportation corridor and Granite Point port site would directly affect about 80 ha (198 ac) of suitable sandhill crane habitat, no suitable trumpeter swan habitat, 149 ha (369 ac) of high quality black bear habitat, and 147 ha (364 ac) of high quality brown bear habitat. Spring/summer/fall moose habitats disturbed would be primarily low and medium quality.

The southern/Granite Point alternative would disturb more sandhill crane habitat than would the Ladd port site alternatives, but significantly less medium quality moose winter range.

5.4.1.2 Impacts to Freshwater Environment

Ground-water Hydrology and Water Quality

- Southern Transportation Corridor

Impacts to the ground-water system due to construction and use of the transportation corridor would be minimal compared to those resulting from the actual mining operations.

Table 5-24

DIRECT LOSS OF WILDLIFE HABITAT AND SUITABILITY OF HABITATS IN HECTARES (ACRES) FROM MINE DEVELOPMENT BY PROJECT COMPONENT

		Port Sites		Transportation Corridors			Housing Facilities and Airport			Material Sites[1]		
Species		Granite Point	Ladd	Southern	Eastern	Northern	Lone Creek	Three-Mile	Congahbuna Lake[1]	#5	#7	#8
Sandhill Crane	Suitable	64(158)	6(16)	16(40)	14(35)	23(56)	0	0	6(15)	0	0	15(37)
	X	0	0	0	0	0	0	0	0	0	0	0
	X	0	0	0	0	0	0	0	0	0	0	0
	Unsuitable	16(41)	113(277)	53(131)	40(99)	50(124)	29(72)	29(72)	23(57)	106(262)	119(294)	119(294)
Trumpeter Swan	High	0	9(23)	0	2(6)	1(3)	0	0	2(5)	0	0	0
	Medium	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU[2]	80(198)	110(271)	69(171)	52(128)	72(177)	29(72)	29(72)	27(67)	106(262)	119(294)	134(331)
Black Bear	High	80(198)	116(287)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
	Medium	0	0	0	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Brown Bear	High	80(198)	116(287)	67(166)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)
	Medium	0	0	2(5)	0	0	0	0	0	0	0	0
	Low	0	0	0	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Moose Spring/Summer/Fall	High	0	0	22(54)	4(10)	5(12)	25(62)	0	10(25)	85(210)	119(294)	91(224)
	Medium	74(183)	116(287)	46(114)	50(124)	68(168)	4(10)	29(72)	19(47)	21(52)	0	45(111)
	Low	6(15)	0	1(3)	0	0	0	0	0	0	0	0
	NU	0	3(7)	0	0	0	0	0	0	0	0	0
Moose Winter	High	0	0	1(2)	0.5(2)	2(4)	0	0	10(25)	0	119(294)	0
	Medium	16(41)	110(271)	3(8)	29(73)	32(79)	0	29(72)	2(5)	0	0	0
	Low	64(157)	6(16)	38(93)	14(34)	22(53)	0	0	3(6)	0	0	0
	NU	0	3(7)	28(68)	19(47)	18(45)	29(72)	0	14(36)	106(262)	0	134(331)
Total		80(198)	119(293)	69(171)	54(134)	73(180)	29(72)	29(72)	29(72)	106(262)	119(294)	134(331)

[1] Exact sighting not finalized.

[2] Not utilized.

Disruption of recharge or discharge areas would be a permanent impact; however, the area disturbed would be small compared to the total recharge/discharge area. Substantial impacts might occur due to fuel or chemical spills during construction and operation of the conveyor and haul road. These impacts could be reduced in magnitude if spill control and prevention measures are followed. Road construction gravel pits could also cause local disturbances to hydrological regimes. If such impacts occurred, they would likely be minor.

- Granite Point Port Site

Potential ground-water impacts during construction and use of the port site would include ground-water quality degradation as a result of chemical or fuel spills from storage and transfer areas. A Spill Prevention, Control, and Countermeasure (SPCC) plan would be prepared and implemented for this facility. Although contamination as a result of spills presents a significant risk to surface water and localized ground-water regimes, prompt and proper use of the SPCC plan would minimize the magnitude of any impacts.

Adverse impacts to ground-water quality could occur from water percolating through the coal stockpile and into ground water. These effects are anticipated to be insignificant. Column and drip leachate tests on Beluga coal (Table 5-25) indicate that drinking water standards would not be exceeded. Although freshwater aquatic life criteria for boron, iron, ammonia-nitrogen, manganese, and zinc could be exceeded periodically, these criteria are for the protection of aquatic life in surface water, not ground water. Water quality characteristics in ground water commonly exceed the criteria for aquatic life (e.g., zero dissolved oxygen, low pH, high metals concentrations). When, and if, the water that percolates through the coal piles resurfaces in a stream or lake, surface water will rapidly dilute the ground water thereby reducing the concentrations of these parameters to levels acceptable to aquatic life. Furthermore, existing water quality for these parameters is periodically above standards. Therefore, no significant cumulative water quality impact is anticipated.

Leakage from sewer lines and the sewage treatment plant would also result in potential degradation of ground-water quality. This potential is considered small.

Ground-water pumpage for potable use would result only in localized impacts.

Table 5-25

EFFLUENT WATER QUALITY FROM COAL LEACHATES

Parameter	Column (1) Leachate	Drip (1) Leachate	Standard (2)
Alkalinity as $CaCO_3$	52	52	20 or more
Aluminum, dissolved (mg/l)	0.2	<0.2	---
Arsenic, dissolved (mg/l)	0.005	0.003	0.05
Bicarbonate as $CaCO_3$ (mg/l)	52	52	---
Boron, dissolved (mg/l)	0.41	0.52	0.043*
Cadmium, dissolved (mg/l)	<0.005	<0.005	0.004*
Calcium, dissolved (mg/l)	8.3	9.8	---
Carbonate as $CaCO_3$ (mg/l)	0	0	---
Chloride (mg/l)	7	13	200
Chromium, dissolved (mg/l)	<0.02	<0.02	0.05
Conductivity (umhos/cm @ 25°C)	260	290	---
Copper, dissolved (mg/l)	0.12	0.10	1.0
Fluoride (mg/l)	0.30	0.24	2.4
Hardness as $CaCO_3$ (mg/l)	36	43	---
Iron, dissolved (mg/l)	0.31	0.02	0.3*
Lead, dissolved (mg/l)	<0.02	<0.02	0.03
Magnesium, dissolved (mg/l)	3.8	4.4	---
Manganese, dissolved (mg/l)	<0.02	<0.02	0.05
Mercury, dissolved (mg/l)	<0.0005	<0.0005	0.0002
Molybdenum, dissolved (mg/l)	<0.2	<0.2	0.07
Nickel, dissolved (mg/l)	<0.2	<0.2	0.025
Nitrogen, ammonia (mg/l)	0.40	0.28	0.020*
Nitrogen, nitrate/nitrite (mg/l)	0.22	0.08	10
Organic carbon, dissolved (mg/l)	35	80	---
pH (units)	7.4 - 7.8	7.3 - 7.7	6.5 - 8.5
Potassium, dissolved (mg/l)	3.0	1.9	---
Selenium, dissolved (mg/l)	<0.002	<0.002	0.010
Sodium, dissolved (mg/l)	22.6	32.1	250
Solids, dissolved (mg/l)	130	165	500^{*3}
Sulfate (mg/l)	12	17	200
Zinc, dissolved mg/l)	0.34	0.083	0.030*

*Parameters with potential to equal or exceed receiving water standards before dilution in a mixing zone.

--- = No standard known.

NOTES:

(1) Bookcliffs 1985.

(2) Standard listed is the most stringent for the various protected water uses in Alaska. Sources: EPA 1976; McNeely et al. 1979; Sittig 1981; ADEC 1982; ADEC 1984.

(3) The standard total dissolved solids is 500 mg/l or no greater than 1/3 higher than natural conditions, whichever is less.

Surface Water Hydrology

- Southern Transportation Corridor

The coal transportation system and haul road includes the main haul road, overland conveyor, and related support facilities. The transportation corridor would occupy an area of approximately 69 ha (171 ac) distributed over six watersheds as shown in Table 5-26.

The area directly disturbed for the construction of the haul road would be about one-third of those shown in Table 5-26. The area directly disturbed for the conveyor system would also be a small portion (one-third to one-half) of the areas shown in Table 5-26. Therefore, hydrologic impacts related directly to construction of the transportation corridor would be insignificant.

A system of 32 culverts would be provided along the transportation corridor including crossings of the five streams listed in Table 5-26. These culverts would be designed to pass runoff from a 10-year, 24-hour storm with no damming of water on the upstream side. To facilitate drainage, ditches would parallel the road on either side. Thus, there would be no obstruction to the existing drainage pathways for surface runoff up to the 10-year, 24-hour storm. During storms more severe than this, short-term ponding of water may be expected on the upstream (western) side of the transportation corridor. This would have the beneficial impact of reducing the flood peaks on the downstream (eastern) side of the corridor but could cause erosion of the roadway.

Care will be taken to avoid unnecessary flooding or draining of wetlands located adjacent to the right-of-way. However, some effect on adjacent wetlands could result; thus the area of impact would be somewhat greater than the 9.1 ha (22ac) shown in Table 5-2. Nonetheless, the total (direct plus indirect) effects of the road and conveyor will still affect a relatively minor fraction of the watersheds crossed.

Roadway construction in southcentral Alaska often causes icing or glaciation adjacent to roads by blocking sheet flow and/or interfering with subtle drainage patterns. Some increase in icing would be anticipated as a result of the transportation corridor. Icing of culverts caused by improper design or maintenance could cause ponding during breakup, blockage of downstream flow, and possible roadway erosion. Blockage of culverts by beavers would also have the potential of creating temporary hydrological changes and possible roadway erosion adjacent to the corridor.

Table 5-26

WATERSHEDS OCCUPIED BY SOUTHERN TRANSPORTATION CORRIDOR

Stream		Drainage area near conveyor crossing	Drainage area within the corridor	Percent of watershed covered by the corridor
1.	Chuitna River	230.1 km^2 (88.85 mi^2)	53.1 ha (131 ac)	0.23%
2.	Tyonek Creek	3.89 km^2 (1.5 mi^2)	16.2 ha (40 ac)	4.2%
3.	Old Tyonek Creek	29.79 km^2 (11.5 mi^2)	35.24 ha (87 ac)	1.2%
4.	Unnamed tributary of Old Tyonek Creek	5.44 km^2 (2.1 mi^2)	22.28 ha (55 ac)	4.1%
5.	Unnamed tributary south of Congahbuna Lake	10.1 km^2 (3.9 mi^2)	14.58 ha (36 ac)	1.4%
6.	Area draining directly to Cook Inlet	N/A	20.65 ha (51 ac)	N/A

N/A = Not applicable

During the operation phase, the runoff generated by the 51 ha (125 ac) of road surface would be about 3 to 4 times that generated at present. However, road surface area in each watershed would be a very small fraction of the areas shown in Table 5-26. Therefore, the net impact on the streamflows and water levels of streams would be negligible.

In the postoperation phase, all facilities, which can not be beneficially utilized for other purposes, would be removed and the area graded to restore the premining drainage patterns as far as possible. Thus, the postoperation hydrologic impacts of the project would be insignificant.

- Granite Point Port Facilities

Construction of sediment ponds at the port facility would require approximately 4.05 ha (10 ac). Diversion ditches and sediment ponds would be built before any other construction activity begins. The surface runoff from disturbed areas would be routed through this system. The combined storage capacity of the three sediment ponds would be 38.5 ac-ft and the net evaporation in the area would be small. Therefore, the runoff volume which would not reach Cook Inlet would be extremely small and the hydrologic impacts of the construction of the port facilities would be insignificant.

During the operation phase, contaminated runoff from the coal stockpiles and equipment washdown areas would be routed to the sediment ponds and treated before being discharged into Cook Inlet. The runoff generated by the built-up areas would be 3 to 4 times that at present. Water storage in sediment ponds would partially attenuate this increased runoff. The net effect on the inflows to Cook Inlet would be negligible.

In the postoperation phase, all facilities which could not be beneficially used, would be removed and the area graded to establish drainage patterns which would carry all surface runoff to Cook Inlet with minimal soil erosion. Thus, the resulting impact on Cook Inlet would be negligible.

Surface Water Quality

- Southern Transportation Corridor

Erosion could occur during construction of the road and conveyor systems and associated support facilities and would continue until all disturbed areas were stabilized. Road and conveyor system construction would include seven stream crossings and construction near two lakes located downslope from the road. In addition, there would be about 4.8 km (3 mi) of construction across muskeg or peat areas. The conveyor would span all streams and would not create undue amounts of erosion. Road construction would entail cut and fill operations and bank disturbances at stream crossings. Increased turbidity and suspended solids levels resulting from watershed disturbances would be proportional to the area disturbed, site gradient, the distance from the disturbance to a stream, and erosion control techniques applied.

Drainage and sediment control measures would be implemented prior to the commencement of facility construction and would be maintained until disturbed areas were stabilized (ACZ Inc. 1985a). Drainage and sediment control measures include: 1) construction of collection ditches and installation of culverts under roads to collect and control runoff from road surfaces, embankments, and adjacent areas; 2) surfacing of main roads and facility areas with gravel material; 3) revegetation of road cuts, embankments, and other disturbed areas as soon as possible after construction to minimize erosion; and 4) utilization of specific localized sediment control measures in sensitive areas such as adjacent to stream channels. In these sensitive areas, applicable control measures would be highly site specific but would include one or more of the following:

- Collection/diversion ditches with rock filter dams
- Gradient terraces with dugout filter ponds
- Rock drainageways
- Placement of sediment filter fabric
- Use of straw or vegetative sediment filters

In addition to the planned drainage and sediment control measures described, regular inspection and immediate repair of surface erosion in facility areas would limit potential impacts to water quality.

Streams in the project area would receive inflow from the transportation system drainage containing higher total suspended solids concentrations than in the streams. The impact of this situation would mainly be dependent on the relative volume of flow from the disturbed sites and the receiving streams and on mixing. The degree of effect would diminish as stream flow increased and would be least when flow was high. Each stream has an inherent capacity to recover from damage caused by siltation. Much accumulated sediment would be flushed from water bodies annually during spring breakup and would be moved downstream. It is anticipated that the transportation system sediment sources would increase annual stream sediment load by no more than 7 percent, most of which would occur during high stream flow periods.

No petroleum products would be stored in the vicinity of the transportation corridor; therefore, the potential for spills into water bodies would be limited to vehicle accidents. Crankcase leaks and overturned vehicles could result in petroleum product spills, but quantities would be small. Appropriate maintenance and quick response to spills would reduce the probability of petroleum products reaching water bodies and adversely affecting water quality.

Coal and soil dust generated during operation would not adversely affect water quality. Dust control measures would be employed using limited applications of water sufficient to control dust but not result in runoff. The conveyor would be covered on the top and one side along its length and provisions would be added to catch coal particles that fall from the bottom where the conveyor crosses the Chuitna River and small streams.

- Granite Point Port Facilities

Site preparation at the port facility would be initiated with construction of drainage ditches and three settling ponds to minimize the effects of construction disturbances on receiving water quality. These sediment control structures would collect all surface runoff from the port facilities area, including the coal stockpile and fuel storage area (ACZ Inc. 1985b). Discharge from the ponds would be to Cook Inlet.

Equipment washdown wastewater would be generated during operation by washing coal dust from coal handling equipment and from the repair and maintenance shop. An oil trap would be installed to remove oil and grease. The wastewater would then flow into coal pile runoff ponds for settling and treatment. These ponds would also receive storm water collected from the coal storage areas, parking lots, and surrounding areas. This water would be treated by sedimentation and possibly chemical addition in the ponds to suitable levels and could be used as make-up water for coal pile dust suppression sprays if sufficient low-cost suitable water is not available from other sources. Only the excess storm water would be discharged. The runoff ponds would be equipped with a skimming device, if necessary, to separate oils, grease, solvents, and other hydrocarbons and route them to a storage area. Waste oil and other used hydrocarbon materials would be collected, stored, and removed from the project area for recycling or for disposal in approved waste disposal sites. Other hazardous materials (e.g., paint, solvents) would be handled and stored separately and shipped from the project area for disposal in approved waste disposal sites.

During operations, adequately-treated surface water runoff from the port site would not adversely affect surface water quality. Domestic sewage at the port site would receive secondary treatment. The maximum number of people at the site during operation would be approximately 55 (ACZ 1985c). They would use about 8,517 l (2,250 gal) of water (per the NPDES permit application) and generate about 4.3 kg (9.4 lbs) of 5-day biochemical oxygen demand (BOD) per day. Secondary treatment would reduce this to less than 0.45 kg (1 lb) of BOD, which would be discharged to Cook Inlet via a pipeline along the trestle. Water quality in Cook Inlet would be unaffected by the treated domestic waste discharge.

Effects of petroleum spills would be the same as described above for the mine and mine service area.

Biology

- Southern Transportation Corridor

The applicant's proposed transportation corridor crosses the upper reaches of two tributaries of Stream 2003 (200302 and 200303) and two tributaries of Old Tyonek Creek, as well as Tyonek Creek, Old Tyonek Creek, and the Chuitna River. All of these areas have documented rearing use by juvenile anadromous, and probably resident, salmonids (ERT 1984a). Coho and chinook salmon spawning may also occur in the vicinity of the crossings of the three larger streams. Construction of the stream crossings would result in temporary bed disturbance and downstream siltation. In addition, runoff from disturbed areas and work pads in the respective drainages may also contribute to increased suspended sediments in the streams. Effects of this increased sediment load would be similar to those described above for mine area streams but would not be expected to last more than a year from completion of construction.

Ponding or dewatering of areas due to access corridor construction would alter the nature of wetland flora in localized areas adjacent to wetlands crossed. Changes would be more or less balanced between wetter and drier conditions. These changes in wetland vegetation would in turn influence the nature of associated fauna. In most cases, the effects on fauna would be slight because most larger species have the ability to move more or less freely between areas and selectively utilize those most favorable to them. Since some areas would be changed to favor those preferring drier areas and those preferring wetter habitats, little net impact is anticipated.

Stream crossing structures would be placed in a manner that would not interfere with passage of juvenile or adult fish so no adverse impacts are anticipated to result from the presence of culverts, bridges or other crossing structures (Section 6.2.2.1). Because the road would not parallel any stream for an extended distance (e.g., greater than 0.5 mi) amounts of calcium or magnesium chloride dust suppressants entering the streams would not be biologically significant.

- Port Area

No significant impacts to freshwater fish populations are expected at the Granite Point port site due to construction, operation or reclamation. Several small ponds that may be filled may have isolated fish populations (e.g., three-spined sticklebacks). However, if present, these would be of little local or regional importance.

5.4.1.3 Impacts to the Marine Environment

Oceanography and Marine Geology

- Physical Oceanography and Ice

The presence of the trestle piers, designed with a wide (122 m [400 ft]) spacing to minimize ice forces on the structure, would cause an insignificant change to the current and ice regimes. The increased turbulence caused by the piers would be very localized, extending perhaps 10-15 m (33-49 ft) in the downstream direction; this would be super-imposed on an already very turbulent background. Overall alongshore/offshore circulation would not be altered in orientation or in magnitude.

Ice passage would be locally affected where it impinged on the piers, and especially at the berthing facility. This would be manifested in breaking of larger ice floes and generation of a downstream wake of broken sea ice. Ice jamming and stacking is unlikely due to the wide pier/ dolphin spacings and deep water; in any case, tidal flow reversal would tend to start clearing any such ice formation within 6 hours.

- Marine Water Quality

Marine construction activities would generate localized turbidity, which would be negligible compared to the high concentration of suspended solids in Cook Inlet waters. No dredging would be required for this planned construction.

Planned wastewater discharges into Cook Inlet marine waters during operation would derive from the sediment ponds and sanitary wastes. The former would include both natural sediments and runoff from the coal stockpiles, fuel storage, and maintenance yard areas. The latter would only be wastes generated at the port facility handled through the sewage treatment plant. The sediment pond wastewater would also be treated if necessary prior to release into Cook Inlet. Both of these effluents would be discharged offshore from an outfall on the trestle and they would be controlled by an NPDES permit (see Appendix D). Monitoring of the water quality would be required to assure that the effluents meet the required standards before discharge into the marine environment.

Cook Inlet is an essentially unpolluted water body, high in sediment, having point sources only at widely spaced locations, including Anchorage, Kenai, the offshore oil and gas platforms, and other scattered sites. Mixing and oxygen content are very high causing rapid dilution of pollutants and oxidation of organics. The high suspended solids in Cook Inlet waters may contribute to settling and deposition of some types of pollutants. The permitted discharge quantities from this project, coupled with an increased sediment load in the Chuitna River, are anticipated to be essentially undetectable beyond the immediate area of the facility.

Suspended sediment concentrations in Cook Inlet vary from 2000 mg/l near Anchorage to 1.0 mg/l near the east side of the Inlet mouth. The Matanuska River, one of several sediment sources in the Inlet, has suspended sediment levels that approximate 3800 mg/l. The suspended load is mostly of glacial origin and maximum values occur at depths of approximately 10 m (3.1 m) near the Inlet head. Concentrations increase with depth south of the Forelands, and concentrations in the lower Inlet generally vary between 1 and 100 mg/l (Peterson et al. 1985).

Unplanned discharges into the marine waters from spills could include diesel, gasoline, lubricants, and/or antifreeze. Such hydrocarbons are refined and potentially toxic; however, they also tend to degrade quickly in the marine environment. Large spills of crude oil resulting from rupture of one of the undersea production pipelines in the area would also be a very remote possibility (see discussion below under Marine Navigation). Spilled materials would be rapidly diluted under Cook Inlet conditions with strong lateral and vertical mixing. Local spill trajectory would be dependent on tide stage as well as wind and wave direction. However, the residence time would be relatively short; net flow is expected to be southwestward from the site, out of Cook Inlet. Risk of significant spill impacts would be reduced by incorporation of an SPCC plan into the port operations. This would include specialized training for the personnel, plus mechanical safeguards such as quick-closing valves in case of unexpected disconnections. Such risks would be further reduced by avoiding fuel offloading operations in adverse weather.

Accidental spills of coal could also occur during shiploading. Such spills would be unlikely and would probably involve small quantities. Coal would not be a significant pollutant. Coal debris is found naturally in Cook Inlet as a result of erosion of marine outcroppings.

- Coastal and Marine Geologic Processes

Shoreline, or seafloor, erosion or deposition impacts from the proposed construction would be localized and negligible. Scour depressions could occur around the trestle piers, although some scour protection might be installed. The barge unloading facility on the beach would be oriented parallel to the shoreline, would not extend onto the tidal flats, and would be generally above high water. Therefore, local changes to the shoreline would be minimal.

The wide pier spacing would not cause significant shoaling or shoreline deposition. No "sand bar" development at the offshore site would be expected.

- Marine Navigation

The routine operations of vessels using the Granite Point coal port should not affect the nearby offshore oil platform activities. These facilities may influence navigation under some sea and weather conditions, but may be considered navigation aids as well. Oil and gas pipelines buried under the seafloor occasionally become exposed in places because of erosion of bottom materials and thus become vulnerable to being snagged by anchors dragged across them. There would be a small risk of rupturing one of the pipelines extending eastward from Granite Point either while anchoring construction barges for trestle construction or in an emergency situation if a drifting coal vessel were to drag an anchor across an exposed portion of a pipeline. The former possibility would be preventable by careful construction management. A ruptured oil pipeline would result in a substantial oil spill.

The increase in marine traffic in Cook Inlet due to this facility would be notable; 150 to 250 vessel transits throughout the year would be added. This would roughly double the regional traffic of larger vessels; however, it should not represent a significant increase in congestion because of the distribution of marine traffic and the location of this site. The main year-round marine activity in the vicinity is the offshore platform operations which involve only a few vessels with very experienced crews. Most traffic is headed to other destinations in Cook Inlet, such as Drift River, Anchorage, and Nikiski. The main impact of this traffic increase would be in pilotage and regulatory clearance activities, normally conducted out of Homer. Fishing vessel activities range across the potential routes for the coal vessels; however, traffic density is very low and no significant adverse impacts would be anticipated.

Biology

Construction of the offshore port facilities would have little direct adverse impact on marine biota in the area. Placement of piles for pier and dolphin construction would disturb a small area of bottom; however, benthic biota are generally sparse or lacking altogether in the area. Driving steel or wood piles during port construction would have the potential for disruption of migration patterns of juvenile and adult anadromous salmonids due to noise. Juveniles can be presumed to be moving largely at the mercy of strong tidal currents and are therefore unlikely to be greatly influenced. Although there is little information regarding the reactions of adult salmon or marine mammals to bursts of waterborne noise such as would accompany pile driving, it is possible that some or many fish and/or marine mammals (e.g., belukhas) moving northward and eastward along the shore might alter their movements to avoid the area during construction. It is not likely that such a deviation in migratory pathway would reduce the number of fish escaping to nearby rivers.

Because of the natural high turbidity in the area, any increases from construction activities would be negligible and, therefore, adverse impacts to marine organisms should also be insignificant.

Normal operation of the coal port facility would have little direct impact on marine biota. The caissons and piles would provide a stable hard substrate that is largely free from burial by moving sediments. However, annual abrasion by ice would prevent establishment of more than an annual epibiotic* community. Turbulent wakes forming behind the caissons or piles would generate some waterborne noise; however, this would differ little from that which is naturally produced by currents passing the large boulders which are common in the shallow nearshore waters of Cook Inlet. Areas of lower velocity behind the piles might be used by some marine animals seeking refuge from the current.

There is little information about the reactions of belukhas to the chronic low noise levels likely to be generated at the port during ship loading. Belukhas do not generally appear to be disturbed by docks and ships and have not been observed to avoid the oil and gas platforms in Cook Inlet (Calkins 1985).

During periods of fog, the trestle and any elevated wires on it might constitute a hazard to flying birds. However, this is not expected to be a significant problem because of the minimal use of the area by birds and because of the low likelihood of collision.

Construction and operation of the facility would not adversely impact any threatened or endangered species because of the absence of such species in the area.

In the unlikely event of a rupture of a diesel or gasoline line on the trestle or of a spill of any petroleum hydrocarbon from a vessel tied up at the wharf, the areas most likely to be adversely impacted would be the broad mudflats to the north and south of the port. Extremely dynamic conditions and lack of significant biota would render effects on the sand and gravel upper beaches around Granite Point negligible. The refined products most likely to be spilled in such an accident would weather quickly under most conditions. However, the rate of transport of spilled hydrocarbons would be rapid and the toxicity of refined products is high. If such a spill coincided with an extreme high tide or wind condition, the salt marshes fringing Trading Bay, Beshta Bay, or the Susitna Flats may be adversely affected. Oiling during such conditions could seriously damage saltmarsh vegetation and kill large numbers of salt-marsh invertebrates, primarily insects. Serious oiling of birds could occur if such a spill occurred during the spring or fall migration and staging periods for waterfowl. During the summer, oiling of these marshes would similarly damage breeding birds and reduce reproductive success. The likelihood of such a spill is low, certainly less than is already present in the area from existing offshore oil and gas production and handling activities.

Commercial Fisheries

If waterborne noise generated during construction causes any offshore deflection of the alongshore migration of adult salmon, there could be a reduction in the harvest success of set net fishermen in the immediate vicinity. Conversely, noise generated at the offshore extremity of the structure might cause fish to concentrate closer to shore, increasing the harvest success of fishermen. However, there is little basis for determining the impact of such activities on fishing success. Certainly, construction activities over a period of 2 years would preclude access to some localized areas at some times for fishing and for navigation. This may affect access to some set net sites depending on the exact location of construction activities.

Once in place, the trestle should not directly interfere with fishing or navigation of vessels because of the negligible impact of the structure on fish movements and because the pile spacing and clearance above the water would allow free passage of most vessels used in the area. Activities associated with the barge landing facility, however, could cause significant impacts during fishing periods if not properly coordinated.

5.4.1.4 Air Quality Impacts

As discussed in Section 5.3.4, the proposed project area is designated as a clean air (attainment) area by EPA for sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), ozone (O_3), and lead (Pb). During project operation, air emissions would emanate from coal handling and transportation and port site activities. Fugitive dust would occur primarily as a result of port facilities construction and along the haul road during operations, whereas stationary PM emissions would result from the port and the conveyor. Specifically, fugitive dust emission sources during operations would be:

- loading of coal onto the overland conveyor system
- handling of coal at the port facility, including transfer points of the conveyor system and ship loading
- storage of coal at the port area (potential wind erosion losses)

Stationary PM emissions sources would be the conveyor and ship exhaust at the port (Tables 5-14 and 5-15). Considerable quantities of criteria pollutants (SO_2, NO_x, CO and THC) would also result from shipping operations.

Results of air dispersion modeling are discussed in Section 5.3.4. Basically, it appears that maximum predicted short- and long-term concentrations, when added to background levels, would not exceed NAAQS in Kenai, Anchorage and Tyonek. Any effects will primarily occur in the immediate vicinity of the development.

5.4.1.5 Noise Impacts

The port site would be one of the two areas (the mine is the other area) with the highest noise levels during project operations. Human receptors in the project vicinity would include project workers and occasional hunters and fishermen. Table 5-22 shows estimated sound levels generated by equipment and facilities.

5.4.1.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts to Anchorage and the Kenai Peninsula would be identical regardless of the mine facilities configuration (see Section 5.3.6.1). Consequently, impacts from the southern/Granite Point alternative would be the same as those from the other corridor/port site alternatives.

Tyonek

General socioeconomic impacts from a mine development have been described in Section 5.3.6.2. Impacts specifically deriving from the southern/Granite Point alternative would be similar to impacts from other corridor/port site alternatives. The Granite Point port site would be 12.9 km (8 mi) from Tyonek and thus would be well removed from most Tyonek community activities. Housing facilities, haul road, and conveyor also would be a substantial distance from Tyonek and no facilities would be on land controlled by TNC. On the other hand, an existing road provides easy access between Tyonek and the port site/haul road vicinity assuring some level of interaction between mine workers and the Tyonek community.

5.4.1.7 Effects on Harvest of Subsistence Resources

The proposed southern transportation corridor bisects Tyonek's primary subsistence use area. In fact, the majority of Tyonek's hunting occurs to the west of this proposed corridor alternative. In 1981, 87 percent of the moose harvested by Tyonek residents was taken west of the corridor location (Fall et al. 1984). This area is currently accessed in three ways. First, Tyonek residents travel to the McArthur River area by boat, primarily for moose hunting in the fall. In addition, areas to the west of the village are reached using the road network that was developed to facilitate logging and oil and gas exploration; this is the most important and heavily used route to the terrestrial hunting areas. Finally, off-road areas are traversed on foot as well as with snowmachines or all-terrain vehicles.

If the project were built, access across the transportation corridor would be provided for in three ways (Fig. 2-7). First, the KPB has required that road crossings be provided in three locations south of the Chuitna River to allow passage across the conveyor. In addition, the conveyor would be buried in ten locations to allow for wildlife crossings. These crossings could also accommodate off-road vehicle access to hunting areas. Finally, there would be at least seven places where the terrain dips at least 2.4 m (8 ft) to allow passage on foot or with an off-road vehicle beneath the conveyor. The largest of these underpasses would be at the Chuitna River, but there could be others as well. Access to hunting areas on the existing road network should remain unhindered if underpasses are located at existing road crossings.

Coastal travel should not be directly affected by the offshore approach trestle if boats are allowed to travel beneath the trestle. The trestle would be supported by single pilings every 122 m (400 ft), allowing ample room for safe travel between piles. In the event that secondary effects, such as changes in underwater topography, occur, there may be restrictions on travel in some conditions. For example, according to Tyonek fishermen, the pier at the North Foreland created a sandbar that hinders local travel, especially during rough weather. This latter possibility would be highly unlikely given the design of the trestle and the depth at the dockhead.

Some Tyonek residents also use the Chuitna River, Tyonek Creek, and Old Tyonek Creek for drinking water. If water quality in these streams is degraded due to erosion or other pollution from the roads, mine, or housing facility, use of these streams for drinking would be adversely impacted.

Actions that affect life cycles or movements of fish and game may also cause impacts to the harvest of subsistence resources. Again, moose and salmon are the two resources of primary concern. Restrictions in moose movements by the transportation corridor could cause changes in moose hunting success if moose were excluded from customary hunting areas; on the other hand, hunting pressure on local populations could be increased if moose are concentrated at crossing areas. This could result in population decreases and more restrictive hunting regulations in the future. If salmon detour around the port facility and trestle, either due to noise and general activity or due to the physical presence of the trestle, then commercial and subsistence harvests may decline near the port facility. Alteration of salmon movements would be unlikely during project operation but could occur during trestle construction. Interference with subsistence fish harvest would not be a long-term impact.

5.4.1.8 Impacts to Visual Resources

Visual resource impacts would be limited by the low use level of the area within the viewshed of the project components. The transportation corridor and port would be visible from the air. From the ground, the port and the conveyor system would be the most visible components. Increased ship traffic would affect visual resources to a certain extent. The overall visual impact is considered to be low to moderate.

5.4.1.9 Impacts to Recreation Resources

This area is not heavily used by sport hunters, sport fishermen, or other recreation users. Disruption of recreation is expected to be minor. Only limited disturbance is expected to moose and black bear movement patterns and habitat since the conveyor system would be designed for minimum interference. The visual presence of the project and noise generated may adversely impact the quality of the "wilderness experience." Since the wilderness aspect of the area is high at present, this impact would be considered significant.

5.4.1.10 Impacts to Cultural Resources

One archaeological site (TYO-064) is located in the vicinity of the proposed port facility. The archaeological investigators (Gerlach and Lobdell 1983) suggested that avoidance is the most acceptable mitigation strategy, assuming that the port facility engineering design can accommodate this measure. If the site were clearly marked and construction/operations personnel were informed of their obligation to ensure its integrity, no adverse impact should result.

Two other possible adverse impacts on cultural resource sites should be considered. The remote possibility of offshore cultural resource sites (such as shipwrecks) in the port site area remains to be addressed. If such sites exist, construction of an approach trestle conceivably could cause direct or indirect adverse impacts. The possibility of secondary impacts to cultural resource sites outside the construction areas as a result of increased human presence in the region would be slight given the topography, vegetative cover, and the paucity of known sites.

5.4.1.11 Regional Use

Most of the areas in the Beluga region which are likely to be developed in the future for coal, timber, hard rock minerals, or hydropower are located to the west of the proposed project. Construction of the southern transportation corridor, and particularly the Granite Point port site, would provide some infrastructure which could serve future developments (e.g., the Placer U.S. Center Ridge coal deposit which is located approximately 9.6 km (6 mi) west of this project's mine service area). Both the transportation corridor and port site would have the flexibility to serve other regional users. Adequate land coupled with a public land ownership pattern would permit expansion and would not preclude other uses. Further, the port site would be consolidated with the existing road system and developments including the Granite Point oil pump station, Nikolai Creek airstrip and the small group of homes and fishing cabins near Granite Point, allowing for more clustered or "nodal" development as opposed to scattered developments in the region.

5.4.1.12 Technical Feasibility

Adequate technology exists to develop the Granite Point port site, the haul road and the conveyor system as proposed. A shoal exists offshore of the Granite Point port site. It would be approximately 2,427 m (2,654 yd) from the end of the elevated trestle and would need to be considered in navigating coal ships during operations.

5.4.2 Northern Transportation Corridor and Ladd Port Site

5.4.2.1 Impacts to Terrestrial Environment

Geology, Physiography and Soils

Construction and operation of the northern/Ladd alternative would result in impacts to the physiography and geology primarily related to gravel extraction and placement similar to those described in Section 5.4.1.1 for the southern/Granite alternative. No figures are available for the estimated amounts of material needed for the northern/Ladd alternative, but the amount needed would probably be less than the 1.9 million m^3 (2.5 million yd^3) needed for the southern/Granite option due to the narrower road width.

Development of a coal transportation-road system within the northern corridor and the facilities at Ladd port site would disturb about 154.5 ha (380 ac) of soils. Approximately

77 percent (119 ha [293 ac]) of the disturbed area would be associated with port site construction. The rest (35.5 ha [89 ac]) would be disturbed by road construction activities. Soil types affected would primarily include the Talkeetna Sandy Loam and Starichkof-Chichantna peats as well as Starichkof peats that are associated with wet areas.

Construction of transportation and port site facilities would result in long-term impacts to the soils that are disturbed during clearing and those that are covered by road bed materials and permanent facilities. Blading of the roadway and area for footings of port site structures and the conveyor systems is considered an irreversible impact, indicating incomplete restoration within 100 years (see Section 5.3.1.2).

Vegetation

The clearing of the right-of-way for the access road and the coal transportation system (2.4 m [8 ft] for the conveyor and 4.6 [15 ft] for the access road would eliminate the native vegetation in a corridor approximately 21.4 km (13.4 mi) long and 35 m (116 ft) wide. The major vegetation type eliminated would be 20 ha (50 ac) of mixed spruce, birch woodland. An additional total of 0.2 ha (0.4 ac) of closed alder tall shrub scrub and 0.4 ha (1 ac) of mesic graminoid herbaceous/ bluejoint-herb would also be eliminated by construction clearing.

Construction of onshore facilities at the Ladd port site would disturb or eliminate a total of 119 ha (293 ac) of primarily open mixed spruce, birch forest. An additional 6 ha (16 ac) of the open low shrub scrub/sweetgale-grass fen type will also be lost during construction. Approximately 3 ha (7 ac) of open water habitat would be eliminated. Because of the longer road length, the northern corridor would disturb somewhat more vegetated terrain than the southern corridor.

Wetlands

Approximately 16 ha (39 ac) of wetlands would be directly disturbed by the northern transportation corridor, would be classified as palustrine - scrub shrub/forested broad leaved deciduous. An additional 13 ha (33 ac) of wetland would be disturbed by the Ladd port site. A portion of the northern transportation corridor intersects the southern end of a large wetland complex that extends from Threemile Creek to the Beluga River.

Table 5-2 shows the types of wetlands disturbed for each facility and compares the alternative corridors and port sites. The total surface area of wetlands affected by the northern/Ladd alternative is approximately one half that of the southern/Granite Point alternative because the Ladd port site contains relatively little wetlands even though the northern transportation corridor contains more wetlands than the southern corridor. The northern corridor contains substantially more wetlands than the eastern corridor.

Wetlands values are discussed more fully in Section 4.3.2.3.

Wildlife

- Northern Transportation Corridor

Adverse impacts from direct habitat loss would be the same as for the southern/Granite Point alternative except that approximately 26 ha (64 ac) of habitat would be lost. Qualitatively, this alternative would impact habitat of greater importance to wildlife because of the increased loss of wetlands.

Potential indirect habitat loss would be greater than the southern/Granite Point alternative to migrating waterfowl (including swans), nesting waterfowl, and shorebirds because the corridor would cross the large wetlands area west of the Beluga power plant. Potential indirect impacts to eagle nesting would be less than the southern/Granite Point alternative which has an eagle nest within 457 m (500 yd) of the access/haul road or conveyor vs 704 m (770 yd) from the northern corridor. Adverse impacts on swan nesting from this alternative would also be similar. While the one nest site indirectly impacted by the northern corridor would be significantly further from the access/haul road and conveyor than the two sites in the southern/Granite Point alternative (approximately 917 m [1,003 yd] versus 305 m [333 yd] and 543 m [594 yd]), this site has consistently supported a successful nesting pair of swans whereas the other two sites have not.

Indirect impacts to sandhill cranes from this alternative would be less than that for the southern/Granite Point alternative since there is very little use of the northern corridor by cranes.

Activity associated with operation of this corridor would likely cause significantly greater indirect habitat loss for brown bears than would the southern/Granite Point alternative.

The northern corridor would cross Lone Creek through riparian habitat important to brown bears for salmon feeding.

Adverse impacts to animal movements from this alternative would likely be greater than those for the southern/ Granite Point alternative because of the increased length of the conveyor and the right angle bend to the south at the eastern end of the northern corridor. This alignment would likely cause more moose and bear interactions with the conveyor. The northern corridor is also more at right angles to major large mammal movements than is the southern corridor. For the main overland conveyor, the planned average frequency of one wildlife crossing every 880 m (962 yd) should minimize impacts to large animal movements.

Noise and disturbance associated with construction of the access/haul road and conveyor would be similar to that for the southern/Granite Point alternative. Bald eagles using the nest on the eastern shore of Tukallah Lake (Fig. 4-4) would be susceptible to disturbance if construction activities occurred within 110 m (110 yd) or if blasting occurred within 805 m (880 yd) between March 1 and July 1.

- Ladd Port Site

Adverse impacts from direct and indirect habitat loss and construction activities would be approximately the same as for the southern/Granite Point alternative, except that there would be significantly less direct and indirect habitat loss for swans and cranes at the Ladd port site.

- Habitat Evaluation

The results of the habitat evaluation study performed for this EIS (Appendix A) are summarized for the various ancillary facilities in Table 5-24. The northern transportation corridor and Ladd port site would directly affect habitats similar in suitability to the southern/Granite Point alternative. Northern/Ladd would affect less high quality moose winter habitat and more medium quality moose spring/summer/fall habitat than would southern/Granite Point.

5.4.2.2 Impacts to Freshwater Environment

Hydrology

- Northern Transportation Corridor

Impacts to ground-water hydrology would be similar to those described in Section 5.4.1.2 for the southern transportation corridor.

The northern corridor would cross 5 streams (5 to 8 total crossings, depending on route), including 2 crossings of Threemile Creek, and 3 sizeable wetland areas. It would skirt both Tukallah and Viapan lakes. There is no site specific information regarding the watershed sizes, expected maximum and minimum flows, or other stream characteristics. However, road and conveyor construction would be similar to that described for the southern transportation corridor (Section 5.4.1.2). Although minor drainage structures may be required at some river crossings, no major bridges, such as anticipated for the Chuitna River in the southern corridor, are planned. Indirect effects of the transportation corridor on water movement in wetlands are expected to be simular to those described for the southern corridor.

- Ladd Port Site

The Ladd port facility would incorporate sediment ponds, ditches, and other drainage structures similar to those described for Granite Point. The port site is located in an area of wetlands (including one small lake). There is no site specific information regarding the number and location of sediment ponds and diversion ditches or the location of the coal stockpile. Generally, it is anticipated that runoff would be 3 to 4 times that at present. Overall surface water impacts would be similar to those described for the Granite Point site.

Surface Water Quality

The kinds of impacts that could occur are the same as described in Section 5.4.1.2 for the southern corridor. Erosion could occur during construction and operation of the road and conveyor systems. Road and conveyor systems would be approximately 21.7 km (13.5 mi) long and would cross 5 streams and 3 significant wetland or muskeg areas. Wetlands water quality may be influenced for approximately 6.4 to 8 km (4 to 5 mi) of the route. Stream crossings would be generally low level minor structures. However, abutments at two streams (Lone Creek and upper Threemile Creek) would be in wetlands or transition wetland-upland areas. The stream crossing at an unnamed creek near the middle of the route would be near the confluence of two tributary portions of the creek. One tributary would parallel the corridor for over 0.5 km (0.3 mi) making roads and crossings more difficult to construct and limit erosion impacts. The route would also pass near two lakes and three smaller ponds.

It was estimated that the transportation system sediment sources would increase annual stream sediment loads in the southern corridor by no more than 7 percent. It is likely that sediment percentage increases in the northern corridor would be higher since streams are smaller and in more stable streambank conditions where background levels may be inherently lower.

Although the northern corridor is longer and crosses more wetland terrain than the southern corridor, the northern corridor crosses fewer major streams. Impacts to surface water quality would be similar for the two corridors. However, water quality impacts would probably be insignificant along any corridor because of the ability to effectively mitigate these kinds of effects with well-designed and installed drainage structures.

Biology

- Northern Transportation Corridor

The northern transportation corridor to the Ladd port site would have up to 7 crossings affecting at least 5 known or suspected areas of use by juvenile salmonids. Streams 2002 and 2003 are important rearing and spawning areas for three species of salmon and also have documented use by resident salmonids (section 4.5.2.2). Tributary 200301 has limited use by juvenile chinook and coho as well as Dolly Varden. Two small tributaries of Lone Creek (200205 and 200206) that would be crossed by the route have not been surveyed in any of the studies to date. Because of their small size, fish use is probably minimal in the area of the crossings but downstream effects of siltation could occur in areas of use by coho and Dolly Varden.

The lower crossing of the mainstem of Threemile Creek and the crossing of its largest tributary also occur in areas of considerable juvenile salmonid habitat and useage by several species of salmonids is high (ERT 1987). Spawning and overwintering is probable near these areas. No fish were taken at the upstream crossing of Threemile Creek in sampling in August 1987 (ERT 1987), but overwintering and rearing of juvenile coho would appear likely in the pool/pond habitat described. Construction of crossings through this type of habitat could result in disruption of wetlands.

Construction of the stream crossings would result in temporary bed disturbance and downstream siltation. In addition, runoff from disturbed areas and work pads in the respective drainages may also contribute to increased suspended sediments in the streams. Effects of this increased sediment load would be similar to those described above for mine area streams but would not be expected to last more than a year from completion of construction.

Stream crossing structures would be placed in a manner that would not interfere with passage of juvenile or adult fish so no adverse impacts are anticipated to result from the presence of culverts, bridges or other crossing structures.

Passage of the access route within 0.4 km (0.25 mi) of Tukallah and Viapan Lakes would improve access to these water bodies. Increased fishing pressure could affect the existing rainbow trout fishery in these lakes. Road construction and traffic dust during operation should have only minimal impact on lake water quality and biota.

Impacts to fish resources would probably be similar when comparing the northern and southern corridors. The northern corridor could potentially affect several valuable small streams while the southern corridor crosses the Chuitna River. Effects of this transportation corridor on water movement and biota in wetlands are expected to be similar to those discribed for the southern corridor.

- Ladd Port Site

No significant impacts to freshwater fish populations due to construction, operation, or reclamation are expected at the Ladd port site. Several small ponds that may be affected may have isolated fish populations (e.g., three-spined sticklebacks). However, if present, these would be of little local or regional importance.

5.4.2.3 Impacts to Marine Environment

Oceanography, Marine Geology, and Water Quality

It is anticipated that the effect of the Ladd port trestle and other facilities would be similar to those described for Granite Point. Oceanographic conditions are similar and facilities would be essentially identical except that trestle length at the Ladd port would be about 305 m (1000 ft) shorter than at Granite Point (assuming an 18 m [60 ft] depth as required for large coal ships). Offshore drilling platforms are not present near Ladd; consequently, hazards and navigation concerns associated with these platforms at Granite Point would not be a concern at Ladd.

Biology

As with the Granite Point facility, construction of the offshore port facilities should have little direct adverse impact on marine biota in the area. One potentially significant difference between the alternate port sites concerns the vulnerability of biological resources in the event of a spill of fuel, oil, or other hazardous substance. The Ladd port site would be located adjacent to the Chuit Flats at the mouth of the Chuitna River. An oil spill affecting the intertidal zone of the Chuit Flats could harm invertebrates, water birds, and juvenile salmon that inhabit the area. In addition, the broad Susitna Flats is located in direct alignment with the Ladd port site. This very valuable waterfowl area could be severely affected if a large spill coincided with high tide conditions. Generally, the resources at risk from spills are greater at Ladd than at Granite Point. It should be pointed out, however, that the likelihood of a large spill is low.

Commercial Fisheries

The kinds of impacts that could occur to commercial fishing from a port facility at Ladd would be similar to impacts that might occur at Granite Point. However, the commercial fishing effort between Chuit Flats and Threemile Creek is greater than in the Granite Point vicinity with nearly continuous set net sites in the proposed port area. The individual sites are also significantly more productive than those at Granite Point. Fishermen have expressed concern regarding the proposed port facilities at Ladd partly because of their experience with present use of the existing barge landing facility and the proposed increase in use during project construction and operation. Activities associated with this facility could cause significant impacts during fishing periods if not properly coordinated. At lower production levels, the coal barge loading trestle would be only approximately 168 m (550 ft) in length and thus associated activities would be close to the beach and would also require coordination during fishing periods. At full production, however, the coal loading facilities at Ladd would be 3,505 m (11,500 ft) offshore in deep water, well out of the nearshore fishing zone. Therefore, impacts, if present, likely would be greater at Ladd than at Granite Point.

5.4.2.4 Air Quality Impacts

The air quality impacts for the northern transportation corridor would be similar to those for the southern transportation corridor during the operational phase of the project. However, because the access/haul road is longer, the construction phase impacts would be greater. The northern transportation corridor haul road distance would be about 21.7 km (13.5 mi) as opposed to 18.2 km (11.3 mi) for the southern route. This approximately 16 percent increase in haul road distance would result in a greater fugitive dust air quality impact for the 24-hour and annual average total suspended particulate (TSP) standards. As mentioned previously, the 24-hour averaging period is of most concern regarding TSP air quality impacts. The peak 24-hour TSP concentration for the northern route would be 58 ug/m^3. Approximately 57 ug/m^3 would be generated by the southern route. When added to a background TSP concentration of 50 ug/m^3, the total impact would be 118 ug/m^3. This is well below the 24-hour TSP standard of 150 ug/m^3; therefore, the construction phase impacts for the northern route would not violate the applicable ambient air quality standard for TSP.

The port activities for this corridor route would be in closer proximity to the Tyonek area than a port at Granite Point. However, it is not anticipated that any ambient air quality standards or PSD increments would be violated during construction and operating activities associated with the northern corridor or Ladd port site.

5.4.2.5 Noise Impacts

The noise impacts for the northern/Ladd alternative would be similar to those described for the southern/Granite Point alternative. The Ladd port site would be 7.2 km (4.5 mi) closer to Tyonek than the Granite Point site; however, a buffer of 5.6 km (3.5 mi) would still exist between Tyonek and the port site and it is not anticipated that there would be significant noise impacts to Tyonek residents associated with construction or operation activities for this alternative.

5.4.2.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts to Anchorage and the Kenai Peninsula would be identical regardless of the mine facilities configuration. Consequently, impacts from the northern corridor/Ladd port site alternative would be the same as described for the southern corridor alternative.

Tyonek

Socioeconomic impacts to Tyonek and the surrounding area with a northern corridor/Ladd port site alternative would be nearly the same as described for the southern corridor/Granite Point alternative. A port site at Ladd would be substantially closer to Tyonek (5.6 km [3.5 mi] as compared to 12.9 km [8 mi]). However, there is currently no bridge across the Chuitna River, making access to the Ladd port site from Tyonek difficult at some times of the year (an ice road provides access in the winter). Although Granite Point is farther from Tyonek, an existing road provides easy access. The distance and access factors probably act to offset each other; the potential for interaction between mine workers and the Tyonek community are likely similar for the Granite Point and Ladd alternatives. If a bridge and improved road were constructed between Tyonek and Ladd at some time in the future, alternatives utilizing the Ladd port site would probably create significantly more intrusion by outsiders into areas traditionally used or occupied by Tyonek villagers. The kinds of impacts that might occur as a result of increased interaction are described in Section 5.3.6.2.

5.4.2.7 Effects on Subsistence Resource Harvest

Tyonek residents make relatively little use of the area north of the northern corridor; consequently, hindered access across this corridor would not affect many Tyonek residents. Use of the area by residents of the Beluga area is essentially unknown but is likely to be light because of the small population and lack of road access.

The northern corridor is likely to have somewhat greater effect on the movements of large mammals (moose and bear) than the southern corridor. This could impact the number of animals available in areas south of the Chuitna River used for subsistence hunting by Tyonek residents. The impact could be either positive or negative depending on whether animals were excluded from the area or kept inside it.

The northern corridor would not directly affect the Chuitna River or enhance access to the river such as might occur with the southern corridor; consequently, corridor-induced impacts to fish resources used for subsistence purposes would probably be somewhat less for the northern corridor than the southern corridor.

When all factors are taken into consideration, the northern corridor would probably have somewhat less impact on subsistence resources and their use than would the southern corridor.

5.4.2.8 Impacts to Visual Resources

As with the southern/Granite Point alternative, the road, conveyor, and port would be visible from the air; the port will be visible to ship traffic on the west side of Cook

Inlet. The port will also be highly visible from the ground. None of the facilities will be visible from the Village of Tyonek or from Anchorage or Kenai. The magnitude of visual impacts would be essentially the same for a northern/Ladd alternative as for a southern/Granite Point alternative.

5.4.2.9 Impacts to Recreational Resources

The presence of the Ladd port could significantly affect existing recreation use and quality of current sport fishing at the mouth of the Chuitna River. At present, two sport fish guides take clients to the mouth of the Chuitna and areas further upstream for day fishing trips. The proximity of the port would increase competition for the resource by bringing more people to the area and would also decrease the quality of the experience by decreasing the wilderness aspects of the site. Sport hunting along the coast for waterfowl also could be expected to be affected by the influx of people into the area. The Ladd port site is not only close to the Chuitna River mouth but is much closer to the Beluga River Flats than is the Granite Point site.

The road and conveyor system would cross Threemile Creek three times, increasing access to this system at every crossing point. It also skirts both Tukallah and Viapan lakes. Tukallah Lake contains rainbow trout, Dolly Varden and 5 species of Pacific salmon; Threemile Creek flows through the lake. Viapan Lake contains rainbow trout. Both of these areas could be expected to experience greatly increased recreation use.

The road and conveyor are much closer to the Beluga River than any of the other alternatives. This area is currently used by sport hunters for both moose and black bear. A road parallel to the hunting area could be expected to introduce more hunters into the vicinity. The presence of all of the facilities would decrease the wilderness quality of this area.

The northern/Ladd alternative would probably have significantly greater impact on recreation use and quality than would the southern/Granite Point alternative.

5.4.2.10 Impacts to Cultural Resources

Reconnaissance surveys conducted in 1983 and 1986 (Lobdell and Gerlach 1983; Lobdell 1986) concentrated on the area from Granite Point to just north of Chuitbuna Lake; no surveys have been done along the proposed northern transportation corridor. Most sites identified in the surveys have been clustered along the coast and none have been found in the vicinity of the proposed Ladd port site. It is likely that a survey along the northern corridor route would not reveal significant archaeological or historical sites, if care were taken to investigate archaeological values prior to construction and to protect any which might be discovered, then impacts would not be expected.

5.4.2.11 Regional Use

Northern Transportation Corridor

This alternative would not be located as favorably as would the southern corridor with respect to most major potential developments within the Beluga region (e.g., the Placer U.S. Center Ridge coal deposit). It would, however, be more favorably located for the smaller Placer U.S. coal lease 8 km (5 mi) west of the Beluga power plant (Fig. 4-1).

The northern corridor would cross between 1.6 km and 2.4 km (1.0 to 1.5 mi) of private land which might restrict other potential uses in the future. The southern corridor would cross no private land.

Ladd Port Site

While the Ladd port site would be on public (Kenai Peninsula Borough) land, its location with respect to private lands in the area as well as its position between the mouth of the Chuitna River and Viapan Lake would probably make it less able to expand to accommodate other major potential users than would a port at Granite Point. Although the Ladd port site would not be consolidated with as many existing facilities as would the Granite Point port site, it would make use of the existing Ladd barge landing site and road system in the area.

5.4.2.12 Technical Feasibility

Adequate technology exists to build both the transportation corridor and the port site for this alternative. A shoal exists offshore of the Ladd port site which would be approximately 1,810 m (1,980 yd) from the end of the elevated trestle. It would need to be considered in navigating coal ships during operations.

5.5 EASTERN TRANSPORTATION CORRIDOR

5.5.1 Impacts to Terrestrial Environment

5.5.1.1 Geology, Physiography, and Soils

Development of a transportation system within the eastern corridor would disturb about 74 ha (183 ac) of soils. Of this, about 24 ha (59 ac) consist of organic soils associated with wetlands, sphagnum and sphagnum-shrub bogs, and black spruce woodland and forest. Starichkof-Chichantna peats and Starichkof peats are associated with these areas and are well represented in the corridor. Talkeetna Sandy Loam soils are associated with upland sites.

The amount of soils that would be disturbed by construction of the Ladd port facilities would be the same as that described for the northern/Ladd alternative.

Construction of a transportation system in the eastern corridor would cause fewer impacts to soils than would the northern corridor because less area would be disturbed (74 ha [183 ac] versus 98 ha [242 ac]). The nature of the impacts would be similar, consisting of soil destruction by construction activities that are required for a road or conveyor system.

5.5.1.2 Vegetation

In order to construct the coal transportation system along this route, a prism approximately 12 m (40 ft) wide for the access/haul road and a prism approximately 7 m (23 ft) wide for the conveyor and its access road would be cleared for 15.9 km (9.9 mi). This would result in the elimination of 36 ha (88 ac) of open mixed spruce/birch woodland, 4 ha (9 ac) of closed alder/tall shrub scrub, 15 ha (34 ac) of low shrub scrub/sweetgale-grass fens due to construction clearing. Impacts at the port site would be the same as described for the northern/Ladd alternative.

This alternative would have impacts similar to the southern/Granite Point alternative but less than the northern/Ladd alternative because the eastern corridor is substantially shorter than the northern corridor.

5.5.1.3 Wetlands

Approximately 2.0 ha (5 ac) of wetlands would be directly disturbed by the eastern transportation corridor, most of which would be classified as palustrine - scrub shrub broad-leaved deciduous/emergent narrow-leaved persistent. An additional 13 ha (33 ac) of wetlands would be affected by the Ladd port facilities.

Table 5-2 shows the types of wetlands disturbed and compares the alternative corridors and port sites. The surface area of wetlands affected by this alternative is less than either the northern corridor/Ladd port site alternative or the southern corridor/Granite Point alternative. Neither the transportation corridor nor the port site interfere with large wetland complexes.

Wetland values are discussed more fully in Section 4.3.2.3.

5.5.1.4 Wildlife

Adverse impacts to wildlife due to construction, operation, and reclamation of this alternative would be the same as for the northern/Ladd alternative except as described below.

- Transportation Corridor

Direct habitat loss and wetlands loss would be less than for the northern/Ladd alternative. The quality of lost wetlands habitat for this alternative would be less than for the northern/Ladd alternative primarily due to the avoidance of the bog west of the Beluga power plant. This alternative would also adversely impact Lone Creek riparian habitat which is less important for brown bears feeding upon salmon than that affected by the northern/Ladd alternative.

Indirect habitat loss from this alternative would be less than for the northern/Ladd alternative since the latter would pass within 457 m (500 yd) of an eagle nest on the eastern shore of Tukallah Lake and would also pass through more important riparian habitat on Lone Creek for brown bears feeding on salmon.

Effects on animal movements would be similar except that the longer northern corridor would likely result in more moose and bear interactions with the conveyor. If adequately designed and spaced large animal crossings were built, however, this difference should not be significant.

Noise and disturbance associated with construction of the access/haul road for this alternative would be similar to that for the northern/Ladd alternative, except that this alternative would not entail timing restrictions for construction activities since it would not have to consider curtailing blasting to protect the Tukallah Lake eagle nest as would the northern corridor.

- Port Site

The impacts from this alternative would be the same since the Ladd port site would be used for both the northern and eastern corridors.

5.5.2 Impacts to Freshwater Environment

5.5.2.1 Hydrology

The eastern transportation corridor to the Ladd port site (Figure 2-8) would have at least 4 stream crossings (Streams 2003, 200301, 2002, and 200205). Crossings of 2003 and 2002 would have impacts similar to those described for the northern/Ladd alternative. Remaining tributaries are small (200205) or crossed relatively high up in the drainage (200301). Impacts of construction of the access road would be similar to but of less magnitude and extent than for the northern route, since no crossing of Threemile Creek would be necessary. A loop of the major tributary to Threemile Creek enters the corridor but could be avoided by the final alignment. This alternative would likely pass more than 0.8 km (0.5 mi) from both Tukallah and Viapan Lake. However, it would likely pass within 0.4 km (0.25 mi) of Chuitbuna Lake.

Impacts within the eastern corridor would be similar to those of the northern corridor alternative. One less stream would be crossed, similar wetlands areas would be influenced, and the same number of lakes would be near the route. However, Threemile Creek would not be influenced nor would the wetlands north of Tukallah Lake. The eastern corridor would cross fewer creeks than the southern corridor and all creek crossings would be minor structures. Indirect effects of the transportation corridor on water movements are expected to be similar to those described for the southern corridor.

5.5.2.2 Water Quality

Oil and hazardous substance spill potential would be similar to other alternatives except that the terrain is more uniform and fewer major streams would be near the road suggesting that spill risk to water bodies would be less with the eastern corridor.

Overall water quality impacts are projected to be lowest on the eastern corridor route because fewer streams and wetlands would be crossed and no major streams or stream crossings would be involved.

5.5.2.3 Biology

The eastern corridor crosses Lone Creek near the mine site. Fish resources would be as described in Section 4.4.4. Few other waterbodies would be affected by the access/haul road and conveyor within this corridor.

Impacts to Tukallah Lake would be as described for Tukallah and Viapan lakes under the northern alternative (Section 5.4.2.2), possibly including increased fishing pressure and minor water quality effects during construction and operation. Effects of the corridor on water movement and biota in wetlands would be simular to those described for the southern corridor.

It is anticipated that the eastern alternative would have significantly less impact on freshwater biological resources than would the southern or northern alternatives.

5.5.3 Impacts to Marine Environment

The impacts would be the same as those described in Section 5.4.2.3 for the northern/Ladd alternative.

5.5.4 Air Quality Impacts

The air quality impact for the eastern transportation corridor would be similar to that described for the southern corridor route. The haul road lengths for these two routes would be about the same (about 17 km [11 mi]). The eastern corridor would be shorter in haul road length than the northern corridor route; hence, the haul road air quality impacts would be somewhat less for this route.

It is not anticipated that ambient air quality standards or PSD increments would be violated for this scenario and its associated construction or operational activities.

5.5.5 Noise Impacts

The noise impacts for the eastern transportation corridor would be similar to those described for the southern corridor and the northern corridor.

5.5.6 Socioeconomic Impacts

Anchorage and Kenai Peninsula

Socioeconomic impacts on Anchorage and the Kenai Peninsula from the eastern/Ladd alternative would be identical to the other alternatives.

Tyonek

Impacts to Tyonek from an eastern corridor alternative would be similar to other alternatives with one important exception. A portion of the transportation corridor would be on land owned by TNC and, thus, the corporation (and the community) would receive base revenues and maintain some degree of control over the transport operation. The ability to retain a voice in activities that affect the quality of life in the village is perceived by village residents as desirable. The eastern corridor alternative would probably have the least adverse impact on the Tyonek community because of this control factor.

5.5.7 Effects on Subsistence Resource Harvest

Tyonek residents make little use of the area north of the Chuitna River; consequently, an eastern corridor alternative would have minimal impact on access to subsistence hunting and fishing areas from Tyonek. The extent of use by residents of the Beluga area is poorly known but probably light due to lack of access. This alternative would have the same potential for affecting animal movements as would the northern/Ladd alternative.

The eastern corridor would have the least potential for impact to fish resources relative to the other corridors.

Taking all factors into consideration, the eastern corridor probably has somewhat less potential for impact on subsistence hunting and fishing than the northern corridor and substantially less than the southern corridor.

5.5.8 Impacts to Visual Resources

The effect of this alternative on visual resources would be similar to that described in Section 5.4.2.7 for the northern/Ladd alternative. Both alternatives encompass the Ladd port site and both include a road and conveyor system in a similar geographic location.

5.5.9 Impacts to Recreation Resources

The impact of this alternative on recreation resources would be similar to, but somewhat less than, the effects of the northern/Ladd alternative. Both alternatives include the Ladd port site; impacts of this component are described in Section 5.4.2.8. The eastern road and conveyor location does not cross Threemile Creek; however, it does cross Lone Creek which is used to some extent by sport fishermen and a local fishing guide. Fewer total drainages are crossed compared to the northern corridor, which decreases the total impact to sport fish use and resources. This alternative is not located as close to Tukallah Lake or Beluga River which would lessen the impact somewhat.

5.5.10 Impacts to Cultural Resources

No archaeological surveys have been conducted along the eastern corridor; however, impacts are expected to be similar to those described for the northern/Ladd alternative.

5.5.11 Regional Use

The impacts of this alternative would be similar to those for the northern/Ladd alternative except that the eastern corridor would not cross the southern extreme of the Placer U.S. coal lease, thus making development of that lease somewhat less economically feasible. This was judged, however, not to be a significant difference considering the relatively small advantage it would provide to the leasee.

5.5.12 Technical Feasibility

Adequate technology exists to build the eastern transportation corridor and Ladd port site.

5.6 HOUSING ALTERNATIVES

5.6.1 Lone Creek Housing Site Alternative

5.6.1.1 Impacts to Terrestrial Environments

Physiography and Geology

Gravel extraction and placement for the housing facility and airstrip would have minimal effect on the physiography of the area. The housing facilities would be built on generally free-draining glacial material. Foundations and access roads for the housing facility would require approximately 30,500 m^3 (40,000 yd^3) of material; the airstrip and access road would require approximately 84,000 m^3 (110,000 yd^3) of material.

Soils

Clearing and grubbing operations related to construction of the housing and airstrip facilities would disturb approximately 29 ha (72 ac) of soil, primarily Strandline variant sandy loam. This is considered a major long-term disturbance due to the permanency of the facilities.

Vegetation

- Community Composition

Construction of the airstrip, housing units, and associated roads would eliminate 29 ha (72 ac) of mainly mixed spruce-birch woodland vegetation (Table 5-1). Damage to vegetation could also result from fuel and chemical spills depending on the type and amount of spill, time of year, type of vegetative community, and actions required for clean-up (Brown and Berg 1980). Spills in communities with wet, organic soils during the growing season are considered to be more damaging than those occurring in mineral soils or during winter. Spill contingency plans would help to prevent or minimize damage.

Reclamation could not occur until the housing and airstrip facilities were dismantled. Reestablishment of vegetation would not occur until 10 to 15 years after project completion. However, the plant communities affected by construction of these facilities are well represented in the area so impacts due to clearing are not considered to be a significant commitment of the vegetation resource.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within the housing and airstrip area.

Wetlands

Only 2 ha (6 ac) of wetlands are expected to be disturbed by construction of the airstrip and housing area. The type of wetlands disturbed would be scrub shrub broad-leaved deciduous/emergent narrow-leaved persistent (Table 5-2). This loss of wetland is considered to be insignificant.

Wildlife

Direct habitat loss from construction of the housing facilities and airstrip would be approximately 29 ha (72 ac). This would be significant on a local basis for song birds and small mammals, but would not be significant for other animals.

Indirect habitat loss for most species would be small and only locally significant as they would likely adapt to the presence of the facilities. However, some displacement of large mammals would occur, especially from human/animal interactions in the vicinity of the facilities. Brown bears would likely avoid the area entirely unless attracted by feeding or improper handling of garbage. The lone eagle nest near these facilities (Fig. 4-4) would be approximately 732 m (2,400 ft) south of the airstrip. This distance should be adequate to prevent long-term abandonment of the nest site due to fixed-wing aircraft activities, even during the nesting period.

Animal movements would not be significantly affected by the presence of the housing and airstrip facilities especially if snow blowers were operated such that high snow berms did not build up on the airstrip.

Construction activities at the housing site and airstrip, aside from direct habitat loss, would have relatively little impact upon bird and small mammal species. However, construction would displace moose and bears to a greater degree than during operation of the facilities and might be of local significance.

Animal/human interactions could be expected to occur during both construction and operations phases of the project. At all project facilities, animals would tend to avoid contacts with humans unless attracted by improperly handled garbage disposal or outright feeding by workers. If this occurred, animals, especially bears, attracted to project facilities would likely become nuisances, cause lost work time, damage buildings or equipment, or become dangerous and have to be killed (Section 6.3.1.3).

Animals in winter, especially moose, would tend to use cleared roads, pads, and the airstrip to avoid moving through deep snow. As evidenced on the Glenn Highway in Anchorage, this would significantly increase the chances for animal/vehicle collisions unless specific operational provisions were made to prevent such occurrences (Section 6.3.1.3).

The habitat evaluation (Table 5-24) indicates that the Lone Creek site occupies high quality bear and spring/summer/fall moose habitat but is above the elevation of winter moose habitat.

5.6.1.2 Impacts to Freshwater Environments

Hydrology

There would be no significant impact to the ground-water regime as a result of construction and use of the Lone Creek housing facilities and airstrip. Potential ground-water degradation exists from fuel and chemical spills. Impacts to the local recharge/discharge relationships would be small.

Before construction of housing facilities begins, a series of diversion ditches and a sediment pond would be constructed which would attenuate the flood peaks and intercept the sediment generated by the disturbed area. Since the disturbed area would be less than 10 ha (25 ac) or 0.04 percent of the drainage area of the Chuitna River, the impacts to surface water hydrology during construction would be negligible.

During the operation phase, the runoff generated by the less than 10 ha (25 ac) of impervious surfaces of the roads, residences, parking lots, and landing strip would be about 3 to 4 times that at present. However, some attenuation would be provided by the sediment ponds. The net impact on the flows and water levels of the Chuitna River would be insignificant.

These facilities would be dismantled, the area regraded and revegetated during reclamation to provide drainage patterns similar to the premining conditions. Therefore, the resulting hydrologic impacts would be minimal.

Surface Water Quality

Runoff from the housing facility construction and operation would be handled using ditches, revegetation, and sediment ponds in the same manner as other site facilities. No adverse effects on water quality are anticipated from the housing project runoff.

Water quality would not be adversely affected by water use or the disposal of treated domestic wastes from the housing facility. The total number of people at the various mine facilities would be 424 during maximum coal production (ACZ 1985c). All personnel would sleep at the housing area, but would work in different locations as follows: 272 at the mine and mine service area, 42 along the transportation corridor, 55 at the port site, and 55 at the housing facilities and airstrip. Since the domestic sewage discharge from the treatment plant at the mine site and the discharge from the housing facility would be at the same location in the Chuitna River and because the port site would have a separate treatment plant discharging to either Cook Inlet or on-site leach field, the effective population discharging to the Chuitna River would be approximately 369. Diamond Alaska indicates in its NPDES permit application that about 94,635 l (25,000 gal) would be discharged to the Chuitna River per day. Historical records of similar facilities suggest that effluent volume might be somewhat greater than indicated in the permit application. About 2.9 kg (6.3 lbs) BOD, 3.6 kg (7.4 lbs) total suspended solids, 0.6 kg (1.3 lbs) nitrogen, and 0.1 kg

(0.3 lbs) phosphorus would be contained within the daily effluent. This discharge could easily be assimilated by the Chuitna River with no adverse impact on water quality (Table 5-27). Stabilized sludge generated by the treatment process would be hauled to the mine area for disposal in an approved landfill located in the mine pit.

Table 5-27

IMPACT OF DOMESTIC WASTE DISCHARGE ON CHUITNA RIVER

Parameter	Discharge	Chuitna River before mixing	Chuitna River after mixing (1)
Flow, cfs	0.06	30 (2)	30.06
BOD, mg/l	19	est. 2	2.04 (3)
TSS, mg/l	22	<1-60	<1-60.04 (3)
Nitrogen, mg/l	3.9	0.08-0.25	0.088-0.258 (3)
Phosphorus, mg/l	0.9	0.01-0.02	0.012-0.022 (3)

(1) Increases would all be projected to be less than 10% of background. Mixed flow would meet water quality standards. Use of the minimum instantaneous flow is conservative because the ADEC will allow a mixing zone based on a higher flow, such as the 7-day, 10-year low flow.

(2) Minimum instantaneous.

(3) Maximum concentration during minimum flow.

Biology

Residents of the Lone Creek housing area on the bluffs above the Chuitna River would be likely to sport fish during spare time. If open to fishing, the greatly increased fishing pressure in the 1 to 2 km (.6 to 1.2 mi) of river near the housing site could significantly impact the numbers of coho and chinook salmon reaching their spawning grounds and could significantly reduce rainbow and Dolly Varden populations in that reach which is seldom fished at present. The Chuitna River is currently closed to chinook salmon fishing above the mouth of Lone Creek. If this regulation remains in effect, potential impact on this species would be alleviated.

5.6.1.3 Impacts to Marine Environment

There would be no impacts to the marine environment associated with the Lone Creek housing area and airstrip.

5.6.1.4 Air Quality Impacts

Fugitive dust would be generated during construction of the housing area and the airstrip. During operations, dust would be generated by vehicle traffic. This would be at a lower rate than during construction and could be controlled. Some burning would occur during site clearing, but should be minimal. Air pollution associated with the housing site and airstrip would likely be insignificant.

5.6.1.5 Noise Impacts

The housing site and airstrip would be relatively low generators of noise. Noise would be highest during construction due to heavy equipment, but levels would be lower than the mine or port facility. Tyonek residents should not be disturbed by noise emanating from either the housing facility or the airstrip.

5.6.1.6 Socioeconomic Impacts

Construction and operation of the housing area and airstrip would provide employment for a limited number of people. The primary socioeconomic impacts would result from the mine itself; see Section 5.4.1.6 for a discussion of the expected effects of the project on Anchorage, Kenai, and Tyonek.

5.6.1.7 Effect on Subsistence Resource Harvest

Potential effects of the housing and airstrip component on subsistence resource availability and harvest would be increased nonresident harvest of subsistence resources, including competition for fish and game with mine employees; and the possibility of increasingly restrictive harvest regulations.

Competition for Fish and Game with Mine Employees

Diamond Alaska has indicated the housing facility would be weaponless and that hunting by workers would be prohibited. Tyonek residents expressed skepticism that this policy would be effective in eliminating hunting by mine workers because of violations of a similar policy at the Kodiak Lumbermill (KLM) in the late 1970s. Nonetheless, assuming that the no hunting policy is effective while workers are on the job, there would likely be an increase in nonresident harvest of moose caused by workers and their friends returning to hunt on their days off. The Lone Creek housing site is less than 0.8 km (0.5 mi) from the Chuitna River; therefore, mine workers would be very likely to sportfish in the Chuitna River if it were open for fishing, especially for king and coho salmon. Increased fishing pressure on these stocks could lead to allocation conflicts. Conflicts between village subsistence hunters and fishermen and non-local hunters and fishermen would increase, especially if the resource base declines.

Effects of Change in Harvest Regulations

Finally, increased harvests of moose or salmon could eventually lead to increasingly restrictive harvest regulations should populations of moose or salmon fall below acceptable levels. This potential effect could be caused by a number of factors, some of which would not be attributable to the Diamond Chuitna Coal Project. However, the cumulative effect of decreased habitat and increased harvest by nonresidents along with external factors such as loss of habitat to other development and increased recreational use of the area by urban residents, could eventually force the Boards of Fish and Game to further restrict Tyonek's harvest of moose and salmon.

5.6.1.8 Impacts to Visual Resources

Impacts to visual resources are expected to be minor when compared to the impact of the mine and mine facilities. The greatest effect would be from the air. This region is considered of moderate visual quality.

5.6.1.9 Impacts to Recreation Resources

A major impact of this alternative upon recreational resources would be fishing by workers in the Chuitna River near the Lone Creek housing site. Over the long term, this fishing pressure could have a significant impact upon the total number of fish available for other recreational fishermen. Increased access to the Chuitna River would also bring additional nonworker recreational fishermen to the area.

5.6.1.10 Impacts to Cultural Resources

No archaeological sites were found in the vicinity of the housing facilities or the airstrip during the baseline resource site survey (Gerlach and Lobdell 1983). The possibility of secondary impacts to cultural resource sites outside the construction areas as a result of increased human presence is expected to be slight.

5.6.1.11 Regional use

The Lone Creek housing site is well located with respect to all three logical mining units within the Diamond Chuitna lease area. Thus, it would probably be used during development and operation of the entire lease area, encompassing a period of several decades. Future major developments within the Beluga region are likely to take place to the north or west of the Diamond Chuitna project area. These developments would likely be at sufficient distances from the Lone Creek site to make its use impractical if it were to remain simply as a worker camp.

5.6.1.12 Technical Feasibility

Adequate technology exists to build both the housing area and airstrip at this location.

5.6.2 Congahbuna Housing Site Alternative

5.6.2.1 Impacts to the Terrestrial Environment

Physiography, Geology, and Soils

Since the design and areal extent of the Congahbuna housing site and airstrip facilities would be similar to the Lone Creek housing site and airstrip, overall impacts in terms of physical site alteration and gravel requirements would be similar.

From the agronomic standpoint, the alternative would primarily involve soils of the Talkeetna Series which closely approximate the soils mapped for the Lone Creek housing facility site. The predictable impacts would, therefore, be similar to those that would result from the Lone Creek site; approximately 29 ha (72 ac) would be disturbed.

Vegetation

Approximately 29 ha (72 ac) of vegetation would be eliminated by clearing for construction of the Congahbuna housing site and airstrip. Although no specific site has been designated, the vegetation of the general location consists primarily of mesic bluejoint graminoid vegetation. No threatened or endangered plant species are known to occur in this area. The loss of this vegetation would not be considered significant.

Wetlands

Direct wetland impacts from construction of the Congahbuna housing site would be nearly identical to the impacts described for the Lone Creek site. The surface area of wetland affected by the Congahbuna housing site would likely be similar to the area that would be affected by the Lone Creek site (Table 5-2). However, the Congahbuna site would be immediately adjacent to wetland areas that receive significant use by waterfowl. Therefore, secondary impacts to wetland values would be significantly greater with this alternative than with the Lone Creek site.

Wildlife

Wildlife impacts due to construction, operation, and reclamation of this option would be the same as those for the Lone Creek site, except that direct habitat loss would occur to wetlands supporting higher levels of waterfowl and shorebird nesting. Unlike the Lone Creek site, however, there would not be an eagle nest within 723 m (2,400 ft) of the airstrip. Considering all factors, the Congahbuna option would probably have greater impacts.

Based on the habitat evaluation analysis (Table 5-24), habitat impacts to the evaluation species for the Congahbuna housing site option would be similar to the Lone Creek option. The Congahbuna housing area could, however, affect one high quality trumpeter swan nesting lake that would not be disturbed with the Lone Creek housing option and moose wintering activity in mild winters.

5.6.2.2 Impacts to Freshwater Environments

Hydrology

Impacts to ground- and surface water hydrology resulting from construction, operation and reclamation of the Congahbuna housing site alternative are expected to be minor. Some reduction of inflow to Old Tyonek Creek or Congahbuna Lake may be expected depending on to which water body surface runoff is directed. This reduction would not be significant.

Surface Water Quality

Water quality impacts due to construction, operation, and reclamation of the Congahbuna housing site alternative would be similar to those of the Lone Creek site. However, runoff and discharges from the Congahbuna site would not impact the Chuitna River since it would be routed to either Congahbuna Lake or Old Tyonek Creek.

Site runoff impacts would not be significant. However, discharge of treated domestic sewage from the Congahbuna housing site would have more significant impact than would discharge from the Lone Creek site since the much smaller Old Tyonek Creek would be the likely receiving water. During low flows in Old Tyonek Creek, treated sewage could provide small but measurable increases in BOD, nitrogen, and phosphorus levels although the treated sewage flow would likely be less than 2 percent of the creek flow.

Biology

Construction and operation of the Congahbuna housing site alternative would have somewhat less potential for fishing pressure impacts on the Chuitna River as described in Section 5.6.1.4 for the applicant's preferred housing location at Lone Creek. Limited angling pressure might occur on Congahbuna Lake itself depending on the facility's proximity to the lake; however, unless boat access could be gained, there would be little impact on the lake's fish populations. Impacts on fish populations in other streams would not differ from those produced by the applicant's Proposed Project.

5.6.2.3 Impacts to the Marine Environment

There would be no difference in impacts to the marine environment if the Congahbuna housing site alternative were used as opposed to the Lone Creek site.

5.6.2.4 Air Quality Impacts

Air quality impacts resulting from construction and operation of the Congahbuna housing site alternative would be essentially identical to impacts from the other housing options.

5.6.2.5 Noise Impacts

Noise characteristics and sound levels associated with operation of the Congahbuna housing site alternative would be identical to those associated with the Lone Creek site. Impacts to human and wildlife receptors would also be very similar except that the project housing area would be located further from the mine area and residents of the housing facilities would be less likely to be disturbed by noise generated at the mine site.

5.6.2.6 Socioeconomic Impacts

Socioeconomic effects on Anchorage and Kenai from construction and operation of the Congahbuna Lake housing alternative would be the same as those produced by the Lone Creek alternative.

This alternative would lessen the potential for workers from the Lone Creek housing site in the applicant's Proposed Project to adversely impact fish populations in the Chuitna River. A serious impact to those populations could affect sport fishing guides from Tyonek and possibly commercial fishermen.

5.6.2.7 Effects on Subsistence Resource Harvest

Although construction and operation of any housing site would remove approximately equal amounts of terrestrial habitat and would likely have similar effects on game animals, the Congahbuna site is in an area that is used extensively by Tyonek residents for subsistence activities. Hence, the effects of habitat loss at the Congahbuna site would cause greater impacts on Tyonek's subsistence hunting than would habitat loss at the Lone Creek site. In addition, the road that traverses the Congahbuna site is one of two major overland access routes used by Tyonek residents to reach hunting areas to the west. The design of a housing facility at this site should incorporate provisions for continued use of this road to avoid impacts to subsistence use of the area to the west.

A positive aspect of the Congahbuna housing site alternative would be that the potential for disruption of salmon populations and rearing habitats is far less than at the Lone Creek site. However, Chuitna River chinook salmon stocks comprise a relatively small proportion of the chinook salmon that pass Tyonek beaches each year. For example, Chuitna River chinook salmon escapements represented less than 5 percent of the enumerated Susitna drainage king salmon escapements between 1976 and 1984 (Delaney and Hepler 1984). Hence, the Chuitna River is only a minor producer of Tyonek subsistence chinook salmon. Overall, the Lone Creek housing site would cause fewer impacts to Tyonek's subsistence use of the area than the Congahbuna housing site.

5.6.2.8 Impacts to Visual Resources

Construction, operation, and reclamation of this alternative would have impacts on visual resources similar to those of the Lone Creek alternative. Visual screening potential at both sites is comparable. Although no estimates of use levels are available, the two sites are near reasonably popular recreation sites (Congahbuna Lake and the Lone Creek/Chuitna River fishery). Therefore, visual exposure and user attitudes would be similar.

5.6.2.9 Impacts to Recreational Resources

Construction and operation of this alternative would likely have more negative impacts upon existing sport hunting than would the Lone Creek alternative, but the difference would not be significant because of the relatively limited amount of sport hunting which presently occurs in the vicinity of Granite Point. Since little sport fishing presently occurs in the Congahbuna Lake area, this alternative would cause few negative impacts to existing uses. Further, this alternative would not have as great a potential for adversely affecting sport fishing on the Chuitna River as would the Lone Creek alternative.

Overall, this alternative would have significantly fewer negative impacts to recreational resources than would the Lone Creek alternative.

5.6.2.10 Impacts to Cultural Resources

Aerial and ground archaeological surveys in the Congahbuna area did not locate any cultural resources (Gerlach and Lobdell 1983). As long as construction/operations personnel are informed of the possibility of encountering an archaeological site and the procedures to be followed should they do so, no adverse impacts to cultural resource sites should occur if this alternative were chosen.

5.6.2.11 Regional Use

The impacts of this option would be the same as for the Lone Creek option except that this site would be further from the center of the three logical mining units within the Diamond Alaska lease area, requiring greater transportation costs and job commuting time for workers.

5.6.2.12 Technical Feasibility

Adequate construction technology presently exists to build this alternative.

5.6.3 Threemile Housing Site

5.6.3.1 Impacts to the Terrestrial Environment

Geology, Physiography and Soils

Overall impacts to geology and physiography would be similar to those described for the Lone Creek and Congahbuna sites (Sections 5.7.1.1 and 5.7.2.1). The type of soils likely to be disturbed is unknown.

Vegetation

Detailed vegetation mapping has not been completed for the Threemile housing site. The proposed site is located on upland terrain and dominant vegetation type is probably mixed spruce-birch woodland. Disturbed surface area would be the same as for the other sites.

Threatened and Endangered Species

No threatened, endangered, or special status plant species are known to occur within this area.

Wetlands

No wetland habitats would be affected by development of the Threemile Housing site; consequently, the northern corridor/Ladd port site alternative with the Threemile housing site would have somewhat less wetland impact than would the same corridor alternative with the Lone Creek housing site. However, it is doubtful whether this difference in wetland impact is significant since the Lone Creek site would affect only 2 ha (6 ac) of wetlands.

Wildlife

Adverse impacts from construction, operation and reclamation of this option would be the same as those for the Lone Creek option, except that human activity could cause greater impacts to swans because of the location within a general area frequented by swans during the summer. Unlike the Lone Creek option, however, there would not be an eagle nest within 723 m (2,400 ft) of the airstrip.

The habitat evaluation (Table 5-24) indicates that the Threemile site would affect lower quality moose spring/summer/fall habitat than would the other housing site options; however, the Threemile site would occupy high quality moose winter range.

5.6.3.2 Impacts to the Freshwater Environment

Hydrology

Construction and operation of a housing facility at the Threemile site is expected to have minimal effects on the ground-water regime. Potential degradation of ground-water quality could occur as a result of fuel and chemical spills and leaks from sewage treatment facilities. Impacts to the local recharge/discharge relationships would be small. There would be no significant difference in impacts between the Threemile and Lone Creek housing sites.

It is assumed that, as with the proposed Lone Creek housing site, diversion ditches and sediment ponds would be built before actual construction begins at the Threemile site. This site is located away from any rivers, streams, lakes, or ponds. It borders a small wetland (Section 5.6.3.1). Surface water hydrologic impacts resulting from construction of the Threemile housing site would be minimal and not significantly different from the Lone Creek site.

Surface Water Quality

Runoff from the`housing facility would be handled using ditches, revegetation, and sediment ponds. No adverse effects on water quality are expected from the housing area runoff.

Domestic wastes would be treated using secondary treatment. Where this treated effluent would be discharged is unknown at this time. Sludge effluent would be hauled to the mine area for disposal in the ongoing pit reclamation process. Impacts to surface water quality from a housing site at Threemile would not be significantly different from a site at Lone Creek.

Biology

The Threemile housing site is not located within easy walking distance of any streams or rivers. Camp residents would be able, however, to access Threemile Creek, Lone Creek, and Tukallah Lake, among others, by road. Therefore, populations of salmon, rainbow trout, and Dolly Varden in these water bodies could be subjected to heavier fishing pressure. Impacts to aquatic resources would likely be less with housing at Threemile than at Lone Creek.

5.6.3.3 Impacts to the Marine Environment

There would be no impacts to the marine environment associated with construction and use of the Threemile housing site.

5.6.3.4 Air Quality Impacts

Air pollution associated with the housing site and airstrip is expected to be insignificant and no different from housing sites at other locations.

5.6.3.5 Noise Impacts

Noise characteristics and sound levels associated with operation of the Threemile housing site would be identical to those associated with the Lone Creek site. Impacts to human and wildlife receptors would also be very similar except that the project housing area would be located further from the mine area and residents of the housing facilities would be less likely to be disturbed by noise generated at the mine site.

5.6.3.6 Socioeconomic Impacts

Socioeconomic effects on Anchorage and Kenai from construction and operation of the Threemile housing alternative would be the same as those produced by the Lone Creek alternative.

This alternative would lessen the potential for workers from the Lone Creek housing site to adversely impact fish populations in the Chuitna River. A serious impact to those populations could affect sport fishing guides from Tyonek and possible commercial fishermen.

5.6.3.7 Effect on Subsistence Resource Harvest

The Threemile housing site is in an area that is seldom used for subsistence activities and significant impacts on fish and wildlife resources from the site itself would be unlikely. Of the housing alternatives, the Threemile site has the least potential for adverse impact on subsistence activities.

5.6.3.8 Impacts to Visual Resources

The presence of the Threemile housing facilities is expected to have minor effects on visual resources. The site would be visible mainly from the air, it would not be visible from the coast. This area is currently considered to be of moderate visual quality and visual impacts would be similar to those from a Lone Creek housing site.

5.6.3.9 Impacts to Recreation Resources

Workers housed at this site would most likely sport fish on the water bodies crossed by, or near, the northern transportation corridor (Section 5.6.3.2) and pressure on recreational resources in the Threemile Creek/Viapan Lake area could increase. However, the Threemile housing site would be expected to have less impact on recreation than the Lone Creek site because of the latter's proximity to the Chuitna River.

5.6.3.10 Impacts to Cultural Resources

No archaeological surveys have been conducted in the vicinity of the Threemile housing site. The likelihood of cultural resources being found in the area is low.

5.6.3.11 Regional Use

The impacts of this option would be the same as for the Lone Creek option except that this site would be further from the center of the three logical mining units within the Diamond Chuitna lease area, requiring greater transportation costs and job commuting time for workers. It would, however, be located adjacent to the Placer U.S. coal lease (Fig. 4-1) and thus in a very suitable location for use if that lease were developed.

5.6.3.12 Technical Feasibility

The technology exists to build the housing facility as shown.

5.7 CUMULATIVE IMPACTS

The Diamond Chuitna Coal Project would not be built in a pristine area, but one in which resource development and some human settlement has already taken place. Oil and gas exploration and development occurred in the region over twenty years ago, resulting in construction of the Beluga power station, an oil pump station at Granite Point with a pipeline south to the Drift River, and a rudimentary road system north of the Chuitna River along Cook Inlet. In the 1970s, as a result of a state timber sale, a small port was developed at North Foreland as was a road system south and west of the Chuitna River. Several airstrips primarily related to oil and gas development are scattered throughout the region. In addition to the Native village of Tyonek, private land received under federal and state land disposal programs supports several families in the Granite Point and

Beluga areas. This project, in providing additional transportation facilities and a residential work camp, would therefore continue the historical process of resource development and introduction of additional people into the region.

Successful operation of the Diamond Chuitna Project would likely make development of other coal and natural resource projects more economically viable because of the increased infrastructure, particularly the port site, it would establish. A working project would also show other potential coal buyers that Beluga region coal can be successfully mined and development of other coal leases such as Center Ridge or Capps would likely be accelerated. These developments would cause significant additional impacts of a nature similar to this project, including additional large mined areas, more roads and airstrips, increased capacity of existing port sites or establishment of new ones, and more people living either in single-status work camps or townsites.

Cumulative impacts to regional hydrology and water quality, especially in the Chuitna River drainage, and resultant impacts to fish populations could be significant. If a worst case scenario is assumed wherein coal mines comparable in size to the proposed project are operated simultaneously on all of the available leases (Figure 4-1) in the area (including the remainder of the Diamond Chuitna lease), then nearly all of the productive northern tributaries to the Chuitna River would be affected to some degree. streams 2003, 2004, and Chuit Creek would likely be altered substantially. Development of the lease area south of the Capps Glacier would primarily affect the less sensitive Beluga River drainage but could also impact the extreme headwaters of the Chuitna River. Development of the easternmost lease area (Figure 4-1) would affect the headwaters of the two major tributaries to Threemile Creek. In total, these potential stream alterations would probably have a significant adverse impact on regional fish populations. Rearing habitat for coho and chinook salmon in the Chuitna River drainage could be reduced by 40 to 80 percent depending on mining plans and the success of stream reclamation. Spawning habitat for coho, chinook, and pink salmon would likewise be reduced, but to a lesser extent because of the greater use of the mainstem by spawning fish as opposed to rearing fish. At least some of these cumulative impacts would be long-term because of the anticipated difficulty in restoring severely altered stream courses to a productive condition in mined out areas.

Under the same worst case scenario, significant adverse impacts to wildlife would also occur. Multiple mines and transportation systems and extensive human activity would affect the movement of large mammals and would exclude them from substantial areas. After reclamation, habitat value would be less than that which now exists for a substantial period of time. However, in the very long-term, wildlife habitats could be restored more readily than could fish habitats.

Further development in the region, including that from this project, would increase pressures for availability of private land for families that wish to live near their jobs rather than commute from Anchorage and Kenai. A higher population would increase pressure for a permanent road connecting with the State's main highway system. This, in turn, would increase ease of access to the Beluga region, further increasing population.

An increase in the permanent population of the region would require additional services from the Kenai Peninsula Borough, especially schools and roads. More people would result in greater losses of wildlife habitat and increased pressures on fish and wildlife populations and recreational uses of the region. Perhaps the most negative cumulative impacts would be sustained by the villagers of Tyonek who would likely experience significant changes to their traditional social, cultural, and subsistence lifestyles. Such changes could be caused by loss of local governing control, increased drug and alcohol traffic, increased competition for traditional subsistence resources, and loss of Tanaina culture and rural way of life.

On a more specific cumulative impact basis, while the project would meet required air quality standards, it would incrementally contribute to the degradation of Cook Inlet air quality. For example, the increase in marine traffic would roughly double the annual number of larger ships in Cook Inlet.

The project would also provide positive cumulative impacts. Present local residents, particularly those in Tyonek, would have an opportunity to seek year-round employment, thereby providing a stable economic basis for the village. If other developments were spurred by the project, additional employment opportunities would be available. In addition, as regional population growth occurred, the service sector of the economy would provide still other sources of employment and would increase services available to local residents.

5.8 UNAVOIDABLE ADVERSE IMPACTS

Reduction in fish productivity, especially salmon, in the Chuitna River system due to direct habitat loss during mining would be unavoidable during the mine life, for a period thereafter (greater than 10 years), and possibly indefinitely. Complete restoration of streams would not be guaranteed. Terrestrial wildlife species would also be adversely affected by habitat removal during mining but to a less significant extent. Regional movements of large mammals, especially moose and bears, would be partially impeded by the presence of the conveyor system and movement patterns would be locally altered.

Greatly increased human activity in the Beluga region would increase contacts both voluntary and involuntary between residents and nonresidents of Tyonek. Impacts resulting from this could be either adverse or beneficial, although at least a portion of the Tyonek population would be likely to view such impacts as adverse.

5.9 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

In this section, the short-term uses of resources are related to the long-term effects of the project on productivity of those same resources. The purpose is to weigh the project's net benefits to residents of the project area, the region, and society as a whole. In general, short-term uses would be those which would occur during the lifetime of the project. Long-term productivity would generally refer to the time beyond the life of the project.

The estimated mine life for the proposed project is 34 years. Additional probable coal reserves exist within the Diamond Chuitna lease area and within other leases nearby. There is a reasonable probability that these reserves will be developed subsequent to completion of mining within the limits of the Proposed Project if market conditions are favorable. Therefore, the short-term exploitation of coal resources may well lead to longer term coal productivity.

Many of the impacts discussed earlier in this chapter would be considered short-term, with many of the greatest impacts occurring during the initial construction and early operational phases of the project. If these impacts were properly mitigated as discussed, adverse impacts on productivity would be primarily short-term. The goal of postmining reclamation would be to return the area to a level of productivity for wildlife and fish which is at least as great as that which existed prior to mining. In view of the analysis presented in Sections 5.3.2.2 and 5.3.2.4, it would appear unlikely that fish productivity in streams directly disturbed by mining could be restored to premining productivity levels. Restoration of wildlife productivity would likely occur over the very long-term; however, such restoration could require up to 40 years postmining.

The increase in economic activity, influx of new residents from outside the region, and other pressures associated with increased human populations in the short term could have a significant long-term impact upon existing regional social and cultural traditions and values. For example, the short-term benefits of project employment might have long-term indirect impacts upon traditional subsistence lifestyles. Increasing dependence upon the cash economy caused by project employment could lead to a lessening of participation in the subsistence lifestyle. While this would not necessarily be bad, at completion of the project, families may have become so dependent upon the cash economy that they would be unable to fully readapt to the subsistence lifestyle if other types of employment were not available.

5.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

A decision to permit the Diamond Chuitna Coal Project and its subsequent construction and operation would irreversibly and irretrievably commit several resources.

At least 330 million short tons of coal would be removed and ultimately consumed as fuel for various needs over the life of the mine. Gravel resources would be mined and used for various project facilities. While the gravel would remain in the vicinity, it would not be practical in most cases to recover it for other future uses or return it to its sources.

The extraction, transportation, and processing of the coal would require a large commitment of energy resources (diesel oil, gasoline, natural gas, etc.) which would be irretrievably consumed. However, the energy gained from the coal would greatly exceed the energy consumed in acquiring the coal.

The soil lithology and geological structure beneath the mine area would be irreversibly altered. Postreclamation topography, while similar to the premining condition, would also be altered. Vegetation, wildlife habitats, and fish habitats would be different from the original condition but not necessarily less valuable or productive, depending on the success of reclamation. The analysis in Section 5.3.1.2 suggests that fish habitat could be irretrievably lost.

Production of fish would be reduced in the Chuitna River drainage during mine operation and for a period thereafter and would constitute an irretrievable loss as described in Section 5.3.1.2.

Some hunting, fishing, and other recreational and subsistence opportunities would be irretrievably lost for the life of the mine and probably for a substantial period thereafter.

Chapter 6.0

Mitigation, Reclamation, and Monitoring

6.0 MITIGATION, RECLAMATION, AND MONITORING

6.1 INTRODUCTION

The term "mitigation" can have several meanings in an EIS process:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the impact by replacing or providing substitute resources or environments or by enhancing the value of an existing environment.

Mitigation by avoiding impacts altogether, as in (a) above, was incorporated extensively throughout the EIS process through elimination or alteration of options or designs to avoid significant effects (Chapter 3.0). Minimizing impacts, rectifying impacts through repair, and eliminating impacts over time, are the forms of mitigation employed by Diamond Alaska in its planning for the Proposed Project.

From the standpoint of environmental regulatory processes, the Diamond Chuitna Coal Project has a number of features that are somewhat different from other large projects that have been reviewed in Alaska. Because of the duration of the project, impacts would be distributed over a substantial period. This contrasts with other kinds of projects (e.g., petroleum development) where impacts are normally greatest during the construction phase and decrease thereafter. The prolonged impact period requires special attention from the permitting agencies especially in planning and administering mitigation programs. In addition, the existence or severity of many of the impacts cannot be accurately predicted in advance. Therefore, extensive monitoring programs have been built into some permits (i.e., ASMCRA) to obtain information to be used in designing new mitigation strategies.

The mitigation plan included in the project proposal, consisting of mitigation measures committed to by the applicant for all project components, is described in Chapter 2.0. The discussion of environmental consequences (Chapter 5.0) has taken these mitigation measures into account. This chapter summarizes the detailed mitigation, reclamation, and monitoring requirements imposed by the State of Alaska through the Alaska Surface Coal Mining Program and other state permitting programs; requirements of federal and local permitting programs; and other measures which could be considered by the permitting agencies. It is therefore necessary to review both chapters 2.0 and and 6.0 in order to ascertain all mitigation measures associated with this project which have been committed to by the applicant, required by the agencies, or which could be considered in permitting programs.

6.2 MITIGATION CONTAINED IN THE ALASKA SURFACE COAL MINING PERMIT AND OTHER STATE PERMITS

Concurrent with the development of the EIS, Diamond Alaska pursued a surface coal mining permit and other permits from the State of Alaska. The Alaska Surface Coal Mining Control and Reclamation Act (ASMCRA) requires that application be made to the Alaska Department of Natural Resources for a permit to conduct surface coal mining. The state program is overseen by the federal Office of Surface Mining Reclamation and Enforcement (OSMRE). The state regulations under ASMCRA must be as effective as the federal OSMRE regulations.

Diamond Alaska applied to the State in January 1985 for a Permit To Conduct Surface Coal Mining. This triggered an intensive state review process which was completed in August 1987 with the issuance of the Commissioner's decision to approve the permit with stipulations. Subsequently, the decision was subjected to an extensive administrative hearing process which resulted in June 1988 in a reaffirmation of the original decision with only minor modifications to two stipulations and extension of the permit term to 10 years.

It is a somewhat unique situation to have a major state permitting action completed before issuance of an EIS for the same project. Because this is the case with the Diamond Alaska project, much of the content of the EIS, particularly those sections relating to the mine area itself, has been determined by the State's ASMCRA permit conditions. These conditions have been reflected throughout this document and are discussed specifically in this chapter.

In addition, the project was reviewed for consistency under the Alaska Coastal Management Program (ACMP). A conclusive consistency decision was issued on June 29, 1988; several stipulations were attached to the decision. Other state permits have been issued including permits from ADF&G and ADEC. The stipulations attached to the ASMCRA permit, the consistency determination, and the other state permits constitute mitigation measures which are required of the applicant.

Two important points should be made regarding the state permitting effort for this project. First, the existing ASMCRA permit was limited to the 10 year mine and mine facilities area; the permit did not cover the haul road, conveyor, housing facilities, airstrip, or port. Further, the permit for this area is valid for 10 years and, by state law, can be renewed every 5 years for the remainder of the mine's 34 year life. Expansion of the mine beyond the 10 year mining area will require a new ASMCRA permit. The ASMCRA decision was made with the realization that predictions of the long term impacts of the mine and the effectiveness of mitigation measures could probably not be made for the entire life of the project. Therefore, monitoring programs and other reviews required during the first 10 years would enable more specific and informed decision making for the remainder of the project.

Secondly, the consistency determination and other state permits were not limited to the mine area; all components of the project were considered. The State divided its review of the Diamond Chuitna project into 3 phases. The June 1988 consistency determination applies to the permits reviewed under Phase 1 which includes the majority of state permits and authorizations for the mine, transportation and housing and port components of the project. In Phase 2, the DEIS and FEIS, EPA and COE permits, and 401 certifications will be reviewed. Plan approvals and air quality permits from ADEC and approvals for detailed facility design such as oil spill contingency plans will be reviewed in Phase 3.

Mitigation measures required by the State of Alaska (ASMCRA and other state permits) are discussed below by project component. Each component is further subdivided into the first ten years and the remainder of the project. This is in keeping with the ASMCRA permit. During the first ten years, construction of the various components and initial operation will take place. The remainder of the project, approximately 24 years, will consist of continued operations and project termination. Commitments contained in the ASMCRA permit application are considered to be permit requirements; permit stipulations comprise the remaining permit requirements.

6.2.1 Mine and Mine Area

6.2.1.1 First Ten Years

ASMCRA Permit Application and Permit Stipulations

The ASMCRA permit application (June 1987 rev.) states that the "mining objectives of the planned Diamond Chuitna Mine are to maximize coal recovery, minimize environmental disturbances, and to restore the mine area to land use capabilities that are similar to conditions existing prior to mining." To this end, the applicant has committed to many mitigation measures in the placement of facilities and operation of the mine.

Construction will take place during the first three years of the permit period. The general activities which will occur are: 1) construction of drainage and sediment control structures, 2) removal of topsoil from construction areas, 3) construction of roads and support facilities, and 4) equipment erection. These have previously been described in Chapter 2.0 of this document.

The following discussion summarizes the content of the ASMCRA permit.

- Drainage and Sediment Control

The drainage and sediment control systems have been designed to assure that sediment-laden drainage is not discharged from construction sites. A system of sediment ponds will be built and maintained within the permit area. Diversion ditches will also be located, built, and maintained to avoid erosion, minimize contributions of sediment to runoff, and serve as primary flow interceptors. Other sediment control measures will include use of sediment filter fabric, and sediment traps. Drainage and sediment control structures will be built before the surrounding drainage area is disturbed. Groundwater from the mine pit will be pumped into the sediment pond system and from there will flow back into the streams. Sediment-related parameters which will be monitored include total suspended solids, settleable solids and turbidity. Detailed descriptions of the drainage and sediment control systems may be found in Section 4.12, Vol. XVII, of the ASMCRA application (June 1987 rev.).

Potential adverse impacts from domestic sewage will be mitigated by installing secondary waste treatment package plants at the mine, housing, and port areas and by providing trained sewage treatment operators as described in the ASMCRA application.

ASMCRA permit stipulations 1 through 6 require additional drainage and sediment control measures. Stipulation 1 requires that single stage flocculation equipment be installed on sediment ponds 1-6, 8-12, 15, and 16. The location of the equipment installation is specified for each pond.

Stipulation 2 pertains specifically to Sediment pond 14 and requires the applicant to prepare revised design information prior to construction. The plans are to demonstrate that the pond has been designed to handle a "worst case" condition throughout its operational life. In Stipulation 3, several conditions are placed on ponds 7, 11, 13, and 15/16 which will receive winter baseflow.

A construction schedule for sediment pond 2A is called for in Stipulation 4. The plan is to be submitted within one year following permit issuance and the pond is to be constructed as quickly as possible. Stipulation 5 calls for plans for sediment pond spillways and outlet channels to be submitted to ADNR prior to construction in order to assure that the spillways and channels can withstand the spillway design flood. Specifications for riprap are established as well as criteria for filter fabric to be used below a riprap layer. It must be demonstrated that a failure of the outlet channel will not impact the integrity of the spillway.

Stipulation 6 requires preparation of a water quality contingency plan to be approved by ADNR and ADEC. The plan is to specifically identify and prioritize treatment measures which would be implemented in the field should the sediment pond discharges fail to meet state water quality standards. A number of options which should be included in the plan are specified, e.g., addition of floating baffles, increasing mixing at flocculation addition stations, addition of flocculant at the in-pit sumps or pump discharge lines, and filtration of drainage at low flows through a porous medium.

Stipulation 15 requires that the applicant inspect all diversion ditches in late summer or after major runoff events and perform any necessary maintenance. Maintenance will include removal of vegetation which is higher than the design flow depth for the ditch and removal of any litter or debris.

Final engineering of sediment pond embankments is treated in Stipulation 19. An engineering report must be submitted to ADNR which includes a complete description of the fill material to be used for the embankment, site-specific descriptions of the physical and engineering properties of the foundation materials, and a demonstration of the stability of each embankment.

- Topsoil Handling and Overburden Stockpiles

Following construction of the drainage and sediment control structures, topsoil will be removed from the construction and mining areas. Topsoil handling plans are detailed in the ASMCRA permit application, Section 4.10, Vol. XVI. All topsoil removed will be stockpiled for later use in revegetation and reclamation. Soil removal and replacement within the area to be mined will be a phased operation coinciding with the overall mining schedule. Soils will be salvaged and reapplied to disturbed areas with two exceptions. Soil overlying light-use roads which are not compacted or contaminated will not be salvaged. Also, soils covering topsoil stockpile sites will not be salvaged.

Topsoil will be stockpiled initially in association with early mining stages. Stockpiles will be designed to minimize wind and water erosion. Unnecessary compaction of the soil will be avoided and stockpiles will be sited away from centers of activity to avoid contamination. Soil will be redistributed such that appropriate soil thickness for revegetation and drainage is achieved; compaction, contamination, and erosion is avoided; soil moisture is conserved; revegetation is promoted; and deterioration of the physical, biological, and chemical properties of the soil is minimized.

In addition to topsoil handling procedures in the ASMCRA application, stipulation 7 of the ASMCRA permit states that topsoil shall be replaced on all reclaimed areas to a depth of six inches. In Stipulation 20, the applicant is required to salvage topsoils and underlying soils to a minimum depth of six inches in all disturbed areas with mineral soils.

Mining will proceed from the east to the west in the pit to be opened in the first ten years of the project and a permanent overburden stockpile will be created. The permanent overburden stockpile will consist of overburden and interburden material from the initial box cuts in the north and south mining areas. This material will not be needed for reclamation at the end of mine life. Section 4.15 (Vol. XX) of the ASMCRA permit application describes the design, construction, operation, and maintenance of the overburden stockpile.

Overburden and interburden will be required following mining to restore approximate original contours. Material which is unsuitable will be diluted with suitable material during primary mixing within the shovel buckets at excavation. Additional mixing will occur in the truck loads. The result will be vertical and horizontal mixing of materials. Selected chemical and physical properties of overburden and interburden will be monitored after the spoils are regraded but prior to the application of topsoil.

The overburden stockpile will be constructed with side slopes which will minimize erosion and will be located on an essentially flat part of the permit area. The stockpile will be inspected periodically by a registered professional engineer and in accordance with a plan approved by ADNR under Stipulation 8 of the ASMCRA permit. This stipulation requires that the permanent overburden stockpile be inspected at least quarterly and detailed mapping provided for each lift of the stockpile. Strength tests as well as ground-water tests are to be conducted on any areas of fine-grained material.

Backfilling operations will begin as soon as mineable coal is removed from a given pit area. Dragline spoils will be graded to establish drainage. Final graded slopes will undulate to minimize erosion and will approximate pre-mining contours. Depressions approximately 5 ft. deep will be left in the graded spoil to mitigate for loss of wetland habitats. Diamond Alaska will replace a 4 ft zone of non-toxic material over the surface of the mined area. Topsoil will be spread over this layer. The surface will be scarified and the site revegetated.

- Revegetation

The details of the revegetation and reclamation plan are discussed in Section 4.08, Vol. XVI (June 1987 rev.) of the ASMCRA permit application. The short-term goal of the reclamation plan is the immediate stabilization of the disturbed sites including erosion and sedimentation control. Diamond Alaska plans to achieve this goal through controlled mining practices, construction of sediment control and retention structures, revegetation with rapidly growing plant species, proper seedbed preparation, and application of mulch.

The long-term goals of reclamation are to establish productive wildlife habitat and create an aesthetically acceptable site which blends with the surrounding terrain and vegetation. The revegetation plan is set forth in Section 4.11, Vol. XVI (June 1987 rev.) of the ASMCRA permit application. Annual monitoring of revegetation will be done to determine success and identify positive and negative factors. ASMCRA permit stipulation 11 requires a minimum density of 500 woody plants per acre be planted in mixed woodland, spruce woodland, and birch woodland areas. At least 100 trees of any combination of spruce, birch, or poplar may be include. Stipulation 16 also establishes requirements for species diversity in woodland communities.

Section 4.11.9, Vol. XVI (June 1987 rev.) of the ASMCRA permit application details the wetland revegetation plan. This wetland restoration program will be conducted on a trial basis and will be monitored to determine its success. Depressions 1 to 2.5 acres in size will be created in the graded spoil. These depressions, which will be approximately 5 ft. deep, will be revegetated with peat from existing bogs within the permit area. Side slopes will be revegetated with herbaceous and woody plant species.

In addition, sediment ponds 7, 17, and 18 will be converted to wildlife habitat revegetation with peat, woody shrubs and other appropriate species. Aquatic insects will be transferred to the ponds from adjacent open water areas; transferal of bottom muck should ensure establishment of macroinvertebrate communities.

- Fish and Wildlife

ASMCRA stipulations 10, 12, 13 and 14 apply to fish and wildlife within the permit area. A complete description of the applicant's fish and wildlife protection plan is found in Section 4.07, Vol. XV (June 1987 rev.) of the ASMCRA permit application. ASMCRA permit stipulation 10 requires that the applicant conduct a three year telemetry program focusing on the moose using the Lone Ridge rutting area. The study will include radio-collaring of adult moose and aerial surveys. The results of the study will be reported to ADNR and ADF&G on a yearly basis. In addition, beginning in permit year 7, ground surveys to determine moose use of revegetated areas is required. Moose/vehicle collision data is to be collected throughout the permit period and submitted to the agencies annually. A monitoring program for the first three years of the project must be formulated and submitted for approval to ADNR to aid in determination of future mitigation requirements.

Stipulation 12 requires verification of flood impact on fish habitat during 1987 spring floods using in-stream flow methodology. The requirement for a fish monitoring program is set out in Stipulation 13. The applicant's proposed program is summarized on Table 6-1 and presented in more detail in Vol. XV, Section 4.07 of the ASMCRA permit application. The ASMCRA permit requires that the program be expanded to include annual adult salmon spawner surveys in drainages 2002, 2003, and 2004. The surveys are to be conducted from mid-July until freeze-up. ADNR and ADF&G will review the survey program at the end of the third year to determine if changes are warranted. Also in the third year juvenile salmon population estimates are to be made in drainages 2002, 2003, and 2004. These surveys are to be conducted every other year in August. A detailed monitoring plan including the above requirements must be submitted to ADNR shortly after issuance of the mining permit. Continuous monitoring of stream and gravel temperatures is required for three locations in Lone Creek and stream 2003 per Vol. XVII of the ASMCRA permit application. ADNR reserves the opportunity to require additional mitigation for fish resources if necessary.

Stipulation 14 deals with fish habitat mitigation. The applicant is required to construct replacement fish habitat to mitigate for the unavoidable loss of two miles of anadromous fish habitat in tributaries 200305, 200304, and 20030502. The mitigation is to include construction and maintenance of at least four 1/2 acre coho salmon rearing ponds adjacent to coho salmon spawning habitat in tributary 2003. Plans for the construction must be submitted to and approved by ADNR and ADF&G. Monitoring to determine the success of the ponds will show whether or not alternative mitigation will be necessary.

- Hydrologic Monitoring

A major goal of the reclamation plan is to restore hydrologic balance and integrity of streams affected by the project as quickly as possible after mining. One of the keys to successfully restoring the hydrologic balance is to restore ground-water equilibrium within the mined-out area as quickly as possible so that the affected streams would again receive a full baseflow. The applicant has proposed to do this by altering the temporary drainage control system at the end of its useful life in order to create permanent depressions in the gradient terraces. These depression would enable water to pond and infiltrate to the ground water. In addition, the applicant expects that natural differential settling in the regraded areas will provide numerous small depressions which will enhance infiltration of precipitation. The wetland restoration program will also aid in ground-water infiltration and baseflow restoration in streams. These mitigation measures, coupled with the restoration of premining slope grades and vegetation, should provide an effective means to enhance the re-establishment of the ground-water equilibrium.

Restoration of mined-out streams to conditions similar to premining is a stated goal of the applicant. If successful, net loss in fish habitat would be minimized (ASMCRA permit application Vol. XVII, section 4.12.3.2). The applicant's proposed plan to hydraulically assess and review the premining stream conditions should provide them with the appropriate baseline information to accomplish this task. Their plan to include the appropriate agencies including hydrologists and fish habitat specialists in the reclamation design phase should enable them to satisfy necessary requirements including reclamation and development of riparian habitat.

The hydrologic monitoring program is detailed in Vol. XVII, section 4.12.9 of the ASMCRA application. ASMCRA permit stipulation 17 requires a quality assurance/quality control program and monitoring reports. Hydrologic monitoring reports are to be submitted quarterly; a summary and analysis report is to be done annually. The purpose of the hydrologic monitoring and reporting program is to determine if actual results are consistent with predictions and that state and federal water quality requirements are being met.

Continuous flow monitoring at seven surface water stations will begin immediately upon commencement of construction and will continue thereafter for the life of the mine. The monitoring locations include two on the Chuitna River, three on Lone Creek (2002), and two on stream 2003. One of the stations on Lone Creek is required by Stipulation 18 which calls for establishment of a continuous gauging station above all mining disturbances. Gauging stations are also required on reclaimed permanent drainages P1 and P2. These stations are to be located below the reconstructed stream channels immediately downstream from the mine area. Water samples are to be taken quarterly.

In addition to the continuous monitoring stations, the applicant will maintain five limited monthly stations located on streams 2002 and 2003. The continuous stations will have continuous recording stream gauges and instantaneous flow will be measured monthly. At the limited stations, instantaneous measurements will be made monthly. Water quality parameters (TSS and turbidity) will be measured at selected stations.

The applicant will include an extensive ground-water monitoring program including 55 wells, located up-gradient, down-gradient, and within the mining permit area. Selected wells will be used to monitor water levels, water quality, and spoil resaturation.

The surface water and ground water monitoring network will allow for the examination of the impact of the mining operations on relative and absolute differences between surface water and ground water contributions to the stream flows in affected areas during the life of the mine. The data will be collected, analyzed, and evaluated on an annual basis and will include a determination of the consistency between predicted and actual changes.

- Bonding

Volume XXII of the AMSCRA application contains detailed information on bonding requirements including projected costs of labor, equipment, and supplies. Bonds are required in three increments. The Increment A bond covers the initial construction and start-up phase (years 1-3) and must be submitted before any work in the ASMCRA permit area may begin. ASMCRA permit stipulation 9 requires establishment of bonding before mining begins in mining increments B and C. Bonding for increment B must be approved before the mine begins operation in year 4.

Coastal Consistency Determination and Other State Permits

State and federal permits for activities within the Alaska coastal zone must be reviewed for consistency with the Alaska Coastal Management Program (ACMP). The state conclusive coastal consistency determination of June 29, 1988 was issued for the state permits issued in Phase 1 of the state review. The permits (other than the ASMCRA permit) which have been issued to date for the mine component include ADF&G Title 16 permits, ADEC solid waste disposal permits, ADNR water rights permits, ADNR material site sales, rights-of-way, and other land leases. Each of these authorizations are conditioned; many of the stipulations are necessary to bring the project into compliance with the coastal management program.

- Alaska Department of Natural Resources

ADNR has major authority over surface coal mining in the State as discussed earlier in this section as well as water rights, rights-of-way over state land, land leases and use permits and material sales. To date, ADNR has issued water rights, material sales contracts, and land leases for the mine and mine area.

ADNR Water Rights, LAS No. 5557

Water rights are granted to develop a drilled well for the mine component. The applicant is required to ensure that wastewater discharges comply with the Alaska Wastewater Disposal Regulations. A metering system must be established and records submitted to ADNR on a quarterly basis.

ADNR, Material Sale Contracts (Chuitna River Site, Old Tyonek Creek Site and Nikolai Creek Site

The sales agreement requires the contract holder to formulate a material site development and operation plan to be approved by ADNR. The contract holder will be responsible for all aspects of site preparation, material extraction, and site restoration. A performance bond is required.

ADNR, Leases for Permanent and Temporary Solid Waste Disposal

The lessor is required to construct and operate the site in accordance with ADEC solid waste disposal permits. A performance bond is required.

- Alaska Department of Fish and Game

ADF&G is responsible for permitting work within anadromous fish streams of the state and for stream crossings on any fish streams. Bridges, culverts, fords, material sites within floodplains, and water intakes are some of the activities which fall under ADF&G's authority. ADF&G also provides input to ADNR on right-of-way leases, to Corps of Engineers on 404 and Section permits through the Fish and Wildlife Coordination Act, and to Division of Governmental Coordination on ACMP consistency determinations.

ADF&G, Title 16 permit, Instream Work in Anadromous Waters

ADF&G has issued four permits for streams within the mine component: 1) Middle Creek Tributary (200304) sediment pond no. 9, 2) Middle Creek Tributary (200305) instream mining, 3) Middle Creek Tributary (200305) sediment pond no. 12, and 4) Middle Creek Tributary (200304) instream mining.

The conditions on each of these permits are the same. The permits require that the applicant mitigate for unavoidable loss of fish habitat by construction of replacement habitat. Mitigation will consist of four 1/2 acre ponds for coho salmon rearing to be located adjacent to coho salmon spawning habitat in tributary 2003. Plans and specifications are to be submitted to ADF&G for approval prior to commencement of construction. Maintenance of the rearing ponds is also required.

An additional four permits have been issued for culvert installation in the mine road within the mine area: 1) Middle Creek tributary (200305) mine road culvert C-6, 2) Middle Creek (2003) mine road culvert C-8, 3) Middle Creek tributary (200306) mine road culvert C-9, and 4) Middle Creek tributary (200306) mine road culvert C-10. The stipulations are the same as those placed on culvert installation in the haul road which are discussed below (6.2.2.1).

- Alaska Department of Environmental Conservation

Solid waste disposal permits, wastewater disposal permits, burning permits, and air quality control permits to operate fall under the purview of ADEC. It should be noted that, although ADEC will issue the appropriate air quality permits, EPA will review and approve the implementation plans. Also, ADEC must issue a state water quality certificate for the Corps of Engineers and EPA actions to assure that discharges into waters of the state comply with Alaska State Water Quality Standards. The water quality standards provide for mixing zones, establishment of which will enable the project to meet receiving water standards.

ADEC, Solid Waste Disposal Facility (construction waste)

This permit allows the development and operation of a construction debris waste disposal landfill facility. The site must be fenced and properly signed. Ditches must be constructed to divert runoff. Extensive stipulations govern the access to the dumping site, burning, hazardous waste, litter, salvage, animal control, monitoring, site closure, and records and reporting.

ADEC, Solid waste Disposal Facility (commercial waste)

This permit covers the development and operation of a sanitary landfill for incinerated commercial waste within the mine site. The stipulations are essentially identical to those listed for the construction waste site above.

6.2.1.2 Remainder of the Project Life

The remainder of the project life includes the period from year 10 through year 34 (project termination). It is anticipated that operations will continue as described above and in Chapter 2.0 of this document. Volumes XI and XVI of the ASMCRA permit application contain further details of project termination. However, the ASMCRA permit does not extend beyond 10 years; therefore, no mitigation in the form of permit stipulations has yet been formulated for the remainder of the project. Future permits will be based on the mitigation and monitoring programs that have occurred in the first ten years. Many of the permits discussed above are for activities which will occur during construction or are for specific permit terms; none extend beyond the SMCRA period.

6.2.2 Transportation Corridor

The transportation corridor, which includes the haul road and conveyor systems, is described in Chapter 2.0 of this document. Only those portions of the transportation system which exist within the mining area are included in the ASMCRA application and permit.

6.2.2.1 First Ten Years

- ADNR Water Rights, LAS No. 5556

ADNR has issued water rights for development of a water source for both the transportation corridor and the housing area. The rights are for a 25,000 gallon/day drilled well. Wastewater discharges must comply with disposal regulations promulgated by ADEC. The system must be metered in a manner acceptable to ADNR and daily water use records must be submitted to the agency on monthly basis.

- ADF&G, Title 16 permit, Instream Work in Anadromous Waters

ADF&G has issued six permits for culvert installation in the southern transportation corridor: 1) Middle Creek tributary (200302) haul road culvert no. 2, 2) Middle Creek tributary haul road culvert no. 6, 3) Tyonek Creek haul road culvert no. 16, 4) Old Tyonek Creek haul road culvert no. 23, 5) Old Tyonek Creek tributary haul road culvert no. 28, and 6) Old Tyonek Creek tributary no. 30.

The stipulations for each permit are similar. The permittee must schedule a preconstruction meeting with ADF&G and submit full plans and specifications, a description of culvert installation methods, and a revegetation plan. The culvert locations must be staked by surveyors and inspected by ADF&G prior to culvert installation. The average cross-sectional water velocity at the culvert outlet cannot exceed 1.8 fps except for a period not to exceed 48 hours during the mean annual flood. At least 1/5 of the diameter of round culverts must be set below the stream bed at both the inlet and the outlet and culverts must be placed in and aligned with the natural stream. Finally, all cut banks, slopes and fills must be stabilized to prevent erosion. Each of the transportation corridors under consideration for this project would be subject to the above stipulation requirements.

6.2.2.2 Remainder of the Project

To date, no state permits have been issued beyond the first ten years. Permits will be applied for as part of the 5 year renewals.

6.2.3 Port Area

The state permits which have been issued are for the Granite Point site; no permits have been issued for the Ladd site.

6.2.3.1 First Ten Years

- ADNR Water Rights, LAS 5558

Water rights have been granted to develop a 2,000 gallon/day drilled well at the proposed Granite Point port site. The permittee is required to establish an acceptable metering system and submit daily water use records to ADNR on a monthly basis. Wastewater discharges are to comply with ADEC regulation.

6.2.3.2 Remainder of the Project Life

No state permits have been issued for port areas for the remainder of the project.

6.2.4 Housing and Airstrip

6.2.4.1 First Ten Years

- ADF&G, Title 16 permit, Instream Work in Anadromous Waters

ADF&G has issued a permit for culvert installation in Middle Creek tributary (200302) for the proposed airstrip. The conditions are similar to those described above for haul road culvert installation (Section 6.2.2.1).

- ADEC, Solid Waste Disposal Permit

This permit was issued to allow development and operation of a sanitary landfill for incinerated waste from a 500 person camp. Stipulations are similar to those described for landfills in the mine area (Section 6.2.1.1).

6.2.4.2 Remainder of Project Life

No state permits have been issued for the housing area and airstrip for the remainder of project life.

6.3 FEDERAL AND LOCAL PERMITTING AUTHORITIES

6.3.1 U.S. Environmental Protection Agency

6.3.1.1 National Pollutant Discharge Elimination System (NPDES)

The mine, housing area, and port (either Granite Point or Ladd) will require NPDES permits for discharge of pollutants to waters of the United States. Draft NPDES permits are found in Appendix D of this document. Four NPDES permits are proposed covering the Granite Point port site, the mine site (sediment pond discharges), the housing area and Ladd coal loading facility. The stipulations proposed for these permits are extensive and include such things as watershed monitoring programs, limitations on chemical composition of effluents, sampling and reporting requirements and development of best management plans. These permits will be issued in conjunction with the EPA Record of Decision on this EIS.

6.3.2 U.S. Army Corps of Engineers

The Corps of Engineers must issue permits under Section 404 of the Clean Water Act and under Section 10 of the Rivers and Harbors Act. The public notice and 404(b)(1) evaluation for this project is found in Appendix C of this document. The permits will be issued in conjunction with the Corps of Engineers Record of Decision for the EIS. No permit stipulations have yet been formulated.

6.3.3 U.S. Fish and Wildlife Service

The USFWS has no permit authority over the Diamond Chuitna Coal Project. However, the agency has prepared a mitigation policy statement which appears in Appendix B of this document. In addition, USFWS reviews COE and other permit actions under the Fish and Wildlife Coordination Act.

6.3.4 Local Permits

6.3.4.1 Kenai Peninsula Borough

Currently, the mine and mine area fall outside the proposed Kenai Peninsula Borough coastal zone; no permits are required under this authority. The Borough does not require building permits and there is no zoning in this area. Therefore, no local permits will be required for the coal project. Rights-of-way over KPB land may need to be obtained depending upon the route chosen for the transportation corridor.

6.4 OTHER POTENTIAL MITIGATION STRATEGIES

This section addresses alternative mitigation strategies and additional potential mitigation measures which may be considered by the permitting agencies. This includes additional mitigation beyond that already committed to in the project mitigation plan (Chapter 2.0) or already required under existing permit approvals (Sections 6.2 and 6.3). It is important to note that the mitigation plan included in the project proposal which consists of mitigation measures committed to by DACC for all project components is not repeated here. The reader is encouraged to refer to Chapter 2.0 which describes those mitigation measures incorporated by the applicant into the project proposal.

The ASMCRA permit review process undertaken by the State of Alaska and DACC was lengthy and exhaustive. Measures which augment those contained in the ASMCRA permit are discussed below. This in no way reflects negatively on the ASMCRA process, but rather shows where mitigation presented in that program might be further addressed within the total ASMCRA mine permit area or applied to project components outside the mine area.

6.4.1 Terrestrial Environment

6.4.1.1 Vegetation

The revegetation program for the mine permit area as reflected in the ASMCRA permit is ambitious and involves a variety of techniques. However, the following items are offered for consideration. Previous experience on other projects within Alaska (e.g., trans-Alaska oil pipeline) suggests that replacement of woody plant species using nursery stock could have inconsistent and unpredictable results (Hilliker 1985). Also, revegetation may be facilitated by the inclusion of native species in the program as much as possible. Use of such species (e.g., Norcoast Bering Hairgrass) would help speed the transition from revegetation communities to natural communities. Moreover, the feasibility of using islands of natural vegetation should be tested as soon as possible as this method would supply seed and propagule source from which naturally-occuring species could reinvade reclaimed areas. Nursery stock, when used, should be from ecotypes that are adapted to the area.

In areas outside the mine permit area, revegetation and monitoring as applied within the ASMCRA area should be required for all disturbed sites which will not be used beyond the life of the mine. Revegetation for erosion control and reclamation should be done throughout the mine life using the same principles discussed for the mine area above.

6.4.1.2 Wildlife

Many of the same types of revegation, drainage, and reclamation measures described in the ASMCRA permit for the mine and mine facilities would provide for habitat reclamation and enhancement and mitigation of impacts to aquatic and terrestrial wildlife resources along the alternative coal transportation corridors and port sites. The location and design of individual mitigation features should be refined and modified according to information provided by ongoing wildlife monitoring programs.

Right-of-way leases for the coal transportation system should include provisions for siting large animal crossings at locations most likely to be used by wildlife. The minimum average frequency, should be as proposed by the applicant in Chapter 2.0, i.e., at least one wildlife crossing each 962 yds. Detailed wildlife utilization patterns should be confirmed by the wildlife monitoring program during the first two years of road operation.

A prohibition of animal feeding should be strictly enforced. The ADF&G regulation prohibiting such feeding (5 AAC 81.218) could be posted conspicuously throughout the camp. All workers should receive environmental orientation which should stress the importance of not feeding wildlife, the usual consequences to the animals themselves, and the potential danger to humans.

Drivers should be made aware of the potential for collisions between moose and vehicles along the haul road. Before construction begins, measures could be developed to minimized the possibility of collisions. The applicant plans to clear vegetation for a distance of between 7.9 m and 15.2 m (25 and 50 ft) from the edges of road surfaces to discourage feeding and increase visibility. In moose concentration areas (e.g., at conveyor crossings), reduced speed limits could be used at dusk and dawn. Additional precautions might include continual clearing of snow from all road surfaces for a sufficient width to permit moose to use the road shoulders rather than compete with vehicles for the road surface itself. Snowblowers could be used to eliminate deep roadside snow berms. On steep or blind curves, lighting could be installed. In the event of collisions, procedures for reporting to ADF&G and salvaging the meat should be established.

Before construction begins, plans could also be developed for dealing with nuisance animals. Measures for handling all situations from removing animals which have wandered into a work area to dealing with dangerous animals could be included in the plan. Trained personnel with proper equipment for animal removal could be available at all times. ADF&G should be apprised of any situations involving animals which may arise during construction or mine operation as required by regulation.

To minimize disturbance of eagle nest trees, construction of roads or other facilities could be avoided within 100 m (110 yd) of the trees between March 1 and July 1. This standard buffer is used by USFS and USFWS in southeast Alaska. If eagles have not nested and laid eggs at the site by May 15, construction could begin. A 457 m (1,500 ft) vertical and horizontal exclusion zone for helicopters could be established around the eagle trees from March 1 through May 15. If nesting did occur, the exclusion zone could continue until September 1.

6.4.2 Freshwater Environment

6.4.2.1 Hydrology

Maintaining the hydrological integrity of the Chuitna River was one of the primary issues identified during the scoping process. As described in Chapter 5.0, significant short- and long-term alterations to hydrological characteristics would result from the proposed project. Two general goals of mitigation would be: 1) to assure adequate flow in the affected Chuitna River tributaries during the period of disruption and 2) to restore hydrologic balance and stream integrity as quickly as possible after mining.

Mine operation would involve development of a complex system of drainage control including peripheral drainage ditches, sediment ponds, and mine pit dewatering. The surface and ground water captured by the mine drainage would represent a loss to the annual flow of several streams. To accomplish the first goal described above, it would be necessary to continuously return the water accumulated by the mine drainage to the affected streams in approximately the same proportions as it was removed. Under current project plans, water releases would necessarily be tied to the settling pond systems and discharge would normally be to the most easily accessible drainages. Allocation of return flows to optimize downstream flow conditions is, therefore, proposed as an optional mitigation measure for consideration by the permitting agencies. Such allocations would be complex, especially in the later years of mining when three streams would be affected. Decisions regarding allocation of return water to the various streams would involve impact trade-offs and should consider the protection and/or optimization of fish habitat.

There is no assurance that sufficient unfrozen water would be available in the winter in the mine pit to supplement stream flows; consequently, some form of water storage might be needed to meet target flows in the winter. The system would need to be continually modified to accommodate mine expansion; this would add considerable cost.

Monitoring of winter flows to assure integrity of fish habitat is also suggested. The hydrology of areas affected by the transportation corridor can generally be maintained by installation of properly designed and installed drainage structures. There are no streams which would be directly affected by the housing area, airstrip, or port sites.

6.4.2.2 Surface and Ground-water Quality

Concern was expressed during scoping regarding the quality of water running off or leaching through coal storage piles. Leaching tests (Bookcliffs 1985) indicate that the water quality would be relatively high and, consequently, Diamond Alaska does not plan to install an impermeable liner under the coal stockpiles at the mine service area or port site. Installation of such liners is suggested as an optional mitigation measure to prevent the remote possibility of ground-water contamination and as a contingency against the possibility that coal from untested portions of the mine could contaminate water to a greater degree than the existing tests indicate. An impermeable liner could have the potential detrimental effect of increasing the amount of contaminated surface runoff collected by perimeter drainage systems. This situation would require additional treatment measures before the water was ultimately discharged to surface waters. The use of impermeable liners is technically feasible but would represent a substantial expense.

6.4.2.3 Aquatic Biology

Physical changes to the Chuitna River drainage and resulting adverse impacts to fish resources represent one of the major issues identified during the scoping process. Adverse impacts to fish, especially salmon, have been identified in Chapter 5.0 as one of the more significant potential project effects. Impacts would include temporary loss of rearing and spawning habitat for coho and chinook salmon because of direct impacts during mine development (Table 5-14) and perhaps a net loss of these habitats in the long-term because of difficulty in restoring streams that have been mined. Because of the significance of these impacts and the interest expressed by regulatory agency representatives, a workshop was held on August 20, 1985, to discuss impacts to aquatic resources, mitigation options, and monitoring needs. Several of the mitigation concepts and monitoring approaches discussed in that meeting have been included by the applicant in the ASMCRA permit application or have been adopted as stipulations on the ASMCRA permit (Section 6.2.1.1). These documents put in place commitments to protect fish habitats, assure adequate restoration, and minimize impacts in those areas where some impact is unavoidable during the first 10 years of mining.

The range of measures included in the ASMCRA permit is considered adequate within the context of the relatively minor impacts that would occur during the early years of mining. However, the following additional suggestions are made:

1. Emphasis in the monitoring program should be placed on quantitative, rather than qualitative measures of fish useage. Where qualitative electroshocking is required, as per Stipulation 13, little additional effort would be required in streams the size of 2002, 2003, and 2004 to conduct 2- or 3-pass quantitative removal estimates. The increased information content in the results would allow much improved assessment of project impacts and the success of mitigation efforts. Quantitative surveys should also be required to evaluate the success of ponds constructed for coho rearing.

2. Performance standards, by which to judge the effectiveness of mitigation or the need for compensatory mitigation, are essential elements of the mitigation strategy. To achieve a goal of no net loss of habitat or fish production, a combination of the following standards might be used to recognize when and where an impact is occurring, to quantify its influence, and to mitigate accordingly:

° Instream flow relationships and requirements among various evaluation species (chinook, coho and pink salmon, and rainbow trout; planned for year 7).

° Numbers of fish normally produced by the affected stream system (statistical comparison of spawner counts and juvenile fish density with pre-project data).

° EPA and/or State of Alaska water quality standards (assessments of likely risk due to any changes in water quality documented during monitoring).

° Correlation of fish abundance trends with any changes in stream hydrology.

° Reclamation of mined out streams outside the 10 year ASMCRA boundary and within the 30 year boundary.

3. During times when construction is undertaken coincident with critical periods of fish spawning and egg incubation, there should be a full-time, on-site environmental monitor, preferably a fisheries biologist, with authority to stop work that may cause major stream disturbances. Such disturbances might include flow interruptions or surges, effects resulting from failure of sediment control structures, and severe water quality effects outside of areas affected by sediment control structures (e.g., along the transportation corridor). This individual should have direct access to and the backing of construction management.

4. The study of the "instream flow needs for spawning, incubation, rearing and migration life stages of anadromous

fish" referred to in Stipulation 13 should consist of construction of habitat time series plots showing actual habitat available for each life history stage through the appropriate times of the year under preproject flows and for year 7 and year 10 flows (assuming sufficiently accurate model calibrations were achieved in the initial IFIM modeling and assuming that no major changes have occurred in channel morphology). This would allow direct comparison of the effects of any project-altered flow regimes on fish habitat of concern and should aid in interpretation of results of monitoring adult and juvenile fish densities.

Many complex decisions possibly involving impact trade-offs would be required over the mine life. Successful implementation of mitigation and restoration measures would require a concerted effort by well-informed persons. A mitigation option is the formation of an aquatic habitat advisory committee consisting of agency and industry personnel which could provide recommendations to project management. Committee members could be selected on the basis of professional qualifications as well as long-term commitment to the project to assure consistency of input. Operation procedures and channels of communication would need to be well defined to avoid unnecessary delays and to allow timely resolution of key issues. Such a committee would tend to minimize impacts by providing the best professional advice on how to maximize the effectiveness of the mitigation opportunities available.

In the initial years of mine operation, a considerable information base will be developed on the actual impacts of mining operations, the success of mitigation measures taken, and the success of reclamation of mined-through streams. This knowledge will be invaluable in planning and implementing mitigation for the greater impacts to surface waters, including two anadromous fish streams (2003 and 2004). Streams to be mined through will require additional mitigation measures beyond those described in detail in the ASMCRA permit application for the initial stages of mining through year 10.

Compensatory mitigation measures and their feasibility in the project vicinity were discussed at the aquatic habitat workshop. A list of options was developed which should be evaluated during the initial years of mining, along with those actually implemented in the first years so that the most attractive options can be put into service on an appropriate timetable. Options include:

- ° Creation of stream access to existing ponds or lakes; this could be combined with deliberate introduction of fish (e.g., sockeye salmon) or without fish introduction.

- Creation of additional new rearing ponds within mined or unmined areas.

- Additional instream habitat improvements similar to, or modified from those planned in the initial mining period.

- Incubation of eggs in incubation boxes within selected portions of the Chuitna River drainage.

- Creation of spawning and incubation channels through enhancement of existing Chuitna River side channels.

- Beaver control and/or dam removal; this may have marginal value as a permanent mitigation measure because of habitat trade-offs.

- Annual removal of stream blockages (including beaver dams) as directed on an as-needed basis by a professional fishery biologist.

- Installation of fish ladders to increase range of fish movements in the Chuitna drainage (workshop participants were not aware of any obvious potential for fish ladder use).

- Optimization of stream habitat via flow allocation; technical and economic feasibility may be limited.

All of the above mitigation options would require detailed site-specific evaluations to determine optimum locations for mitigation sites. A study of compensatory mitigation opportunities in the Chuitna River watershed should be conducted during the first two years of mine site preparation to allow the development of a detailed mitigation plan prior to the time when habitat losses might occur. Such an approach would be consistent with the statutory responsibilities of ADF&G relative to the issuance of Fish Habitat Permits per Alaska Statute 16.05 as well as the goals of Appendix B. Detailed mitigation planning could be phased to correspond with the permit terms dictated by the ASMCRA permit. The aquatic habitat committee described in the previous section should continue to function as described for the remainder of the project life and through completion of the reclamation phase.

6.4.3 Marine Environment

Pile driving and other highly disruptive in-water activities that might be required for trestle construction could be discontinued during the peak periods for chinook and sockeye salmon migration to minimize adverse impact on set net fisheries and on the fish themselves.

Commercial fishing success near the port area could be monitored in cooperation with ADF&G after trestle construction. Monitoring could be continued for at least 3 years to detect whether the port facilities affect fishing success.

6.4.4 Air Quality

The generation and transport of dust and other particulate emissions created by various project activities should be monitored with emphasis on potential impacts to centers of human habitation. Primary emphasis should be placed on fine particulate matter (PM-10) and visibility impacts on the Tuxedni National Wildlife Refuge (Class I airshed).

6.4.5 Socioeconomic Aspects

The scoping response indicated considerable concern on the part of Tyonek residents that they have the opportunity to reap some benefit from the project to offset some of the adverse impacts that might occur to Native lifestyles and traditional subsistence resources. Programs by the applicant to promote employment of Tyonek residents, to enhance the quality of life in other ways, and to generally establish good relations between the mine development organization and the village of Tyonek might be appropriate and desirable.

6.4.6 Cultural Resources

Baseline studies did not examine all project facility sites in detail for antiquities and historic resources because not all facilities locations were clearly identified at the time of the studies. Therefore, additional surveys could be conducted prior to construction. When project siting is definitely within areas proposed for development, the location could be adjusted to avoid the site or the site could be examined and cleared using a methodology approved by the State Historic Preservation Officer.

6.4.7 Subsistence and Recreation

Periodic monitoring of postproject subsistence and recreation use patterns and success rates could detect project-induced changes. Monitoring efforts should be coordinated with ADF&G subsistence monitoring programs.

Chapter 7.0

Consultation and Coordination

7.0 CONSULTATION AND COORDINATION

7.1 INTRODUCTION

A designated purpose of an EIS is to actively involve regulatory agencies and the public in the decision making process. EPA conducted a broad public and interagency consultation and coordination program throughout development of this EIS. Input was solicited from the beginning of the project and this input has been incorporated into the document. Specific public and agency involvement is described below.

7.2 SCOPING

The scoping process conducted by EPA provided an opportunity for members of the public, special interest groups, and agencies involved in the EIS process to assist in defining significant environmental issues. Main objectives of these scoping meetings were to:

- present an overview of the proposed Diamond Chuitna Coal Project;
- identify the major environmental issues to be addressed in the EIS;
- identify areas where additional information was needed;
- receive comments and questions regarding environmental impact concerns; and
- incorporate those comments and questions into the EIS planning process.

The formal scoping meetings and the approximate number of persons in attendance were as follows:

Date	Location	Attendance	Participants
Jan. 8, 1985	Anchorage	17	State & federal agencies
Jan. 8, 1985	Anchorage	80	Public meeting
Jan. 9, 1985	Soldotna	20	Public meeting
Jan. 10, 1985	Tyonek	27	Public meeting

In addition to the formal scoping meetings, the following prescoping meetings were held to provide information about the project and solicit questions and comments:

Date	Location	Attendance	Participants
Dec. 11, 1984	Anchorage	16	State & federal agencies
Dec. 12, 1984	Anchorage	2	Alaska Center for the Environment; Trustees for Alaska

The oral and written comments and questions received during and following the scoping meetings were documented in a Responsiveness Summary (EPA 1985). Its purpose was to provide a public record of the issues and concerns raised, to provide a response to those issues and concerns, and to serve as a blueprint for the EIS process to follow. A summary of the comments received at the scoping meetings and from written responses is shown in Table 7-1.

7.3 AGENCY INVOLVEMENT

Because of the size and nature of the project, several federal, state, and municipal agencies have been involved in the EIS process. These entities and their major responsibilities are listed below:

Federal Agencies

- U.S. Environmental Protection Agency: The EPA is the lead federal agency for the Diamond Chuitna Coal Project and has responsibility for preparation of an EIS that meets National Environmental Policy Act (NEPA) requirements. Additionally, EPA has responsibility for issuing National Pollutant Discharge Elimination System (NPDES) permits for wastewater discharge. EPA must also concur on issuance of a Section 404 permit (see U.S. Army Corps of Engineers below).

- U.S. Army Corps of Engineers: The Corps is a cooperating agency for the EIS and has responsibility for issuing Section 404 wetlands and Section 10 navigable waters dredge and fill permits.

- U.S. Fish and Wildlife Service: The USFWS has responsibility for certain threatened and endangered species and has advised and consulted with other federal and state agencies on fish and wildlife issues.

- National Marine Fisheries Service: The NMFS has responsibility for certain threatened and endangered species and has advised and consulted with other federal and state agencies on anadromous, marine, and intertidal fish and marine mammal issues.

TABLE 7-1

MATRIX OF COMMENTS RECEIVED FROM SCOPING MEETINGS AND WRITTEN RESPONSES

	Comment Sources																Summary	
	Meetings				Written Comments												Number	
	Agencies	Anchorage public	Soldotna public	Tyonek public	Public	Environmental groups	Other groups	Fish & Wildlife Service	EPA	Nat'l Park Service	Adv. Coun. Hist. Pres.	Corps of Engineers	Dept. Nat'l Res. (Parks)	Dept. Fish & Game	Dept. Environ. Cons.	Diamond Alaska Coal Co.	Comments	Sources
A. Physical Environment																		
1. Water																		
Quality			1	2	8	8	1	4						2	3		29	8
Quantity								4									4	1
Surface hydrology		1				1		2	1					3	1		9	6
Groundwater hydrology			1			2		2						2	1		8	5
Marine hydrology						1											1	1
2. Air quality		2	1		1	1	1		8								14	6
B. Biological Environment																		
1. Wetlands						1						3					4	2
2. Freshwater fish			1	1	3	2		1						1			9	6
3. Marine Biology					1	1	2	1				1		1			7	6
4. Wildlife					5	4		4						11			24	4
C. Human Environment																		
1. Employment		2		2	1												5	3
2. Subsistence		1		1	5	2								1			10	5
3. Lifestyle		1		1	7	1											10	4
4. Commercial fishing			1		5	1	1										8	4
5. Increased access		1			1	1	1	2						2			8	6
6. Population increase				1	1			1									3	3
7. Socioeconomics		1	1		1		1										4	4
8. Land use												1					1	1
9. Wilderness		1			1												2	2
D. Project Design and Construction																		
1. Facilities siting						1									1		2	2
2. Mine area																		
Strip mining		1			2												3	2
Overburden stockpile					1	3		1						1	2		8	5
Topsoil storage		2				1											3	2
Coal stockpiles		1				1	1	1									4	4
Coal processing	1	1				1		3									6	4
3. Transportation																		
Corridor location		1			2	1											4	3
Conveyor system	1	2	1		4	1	1	1							1		12	8
Road system			1					2									3	2
4. Port site																		
Trestle	1	2			1			2				2					8	5
Vessel traffic			1		1							1					3	3
5. Housing/airstrip								2									2	1
6. Power generation		1	1		1	2		1							1		7	6

TABLE 7-1
(continued)
MATRIX OF COMMENTS RECEIVED FROM SCOPING MEETINGS AND WRITTEN RESPONSES

	Comment Sources																Summary	
	Meetings				Written Comments												Number	
	Agencies	Anchorage public	Soldotna public	Tyonek public	Public	Environmental groups	Other groups	Fish & Wildlife Service	EPA	Nat'l Park Service	Adv. Coun. Hist. Pres.	Corps of Engineers	Dept. Nat'l Res. (Parks)	Dept. Fish & Game	Dept. Environ. Cons.	Diamond Alaska Coal Co.	Comments	Sources
7. Drainage control and wastwater treatment	1					7		4	3					2	2		19	6
8. Sewage & solid waste disposal					2			2									4	2
9. Soil erosion/ stabilization		1	1	1	1	2											6	5
10. Blasting								1	1					1			3	3
11. Fuel/reagent spills					1			2							1		4	3
12. Herbicides								1									1	1
13. Borrow sources								1						1			2	2
14. Dust control					7			2									9	2
15. Noise					3												3	1
16. Economics		3			1											1	5	3
17. Technical feasibility																1	1	1
18. Reclamation	4		2	1	3	1		2	1			1		4			19	9
19. Mitigation	3					2	1		3			1					10	5
20. Monitoring	1		1	2	2	1			1								8	6
E. EIS PROCESSES																		
1. Generally applicable comments					5	1	1			1	2	2	1				13	7
2. Baseline data presentation	2							2	2								6	3
3. Cumulative impacts		2	1			2		1									6	4
4. Tiered EIS								1									1	1
5. Alternate energy sources analyses		1	1			2											4	3
6. Regional perspective		1	1			1											3	3

State Agencies

- Department of Natural Resources: The DNR has responsibility for issuing the Surface Mining Permit under authority of the Alaska Surface Coal Mining Control and Reclamation Act. In addition, DNR has responsibility for issuing right-of-way permits across state land, tidelands permits and leases, water rights permits, gravel source permits, permits to construct and modify a dam, and burning permits.

- Department of Fish and Game: The ADF&G has responsibility for issuing Title 16 permits for any actions in anadromous fish streams or which might obstruct fish passage.

- Department of Environmental Conservation: The DEC has responsibility for issuing a Certificate of Reasonable Assurance that states the proposed project would meet state water quality standards. It must also authorize plans, specifications, and proposed methods of operation to assess air quality emission standards and to assure proper disposal of solid wastes. The agency also reviews oil spill contingency plans.

- State Historic Preservation Office: The SHPO has responsibility for issuing a clearance for construction following adequate archaeological surveys.

- Governor's Office of Management and Budget: OMB must concur with the applicant's coastal zone management consistency determination that, to the extent practicable, the project would be consistent with the approved state coastal zone management plan.

Local Government

- Kenai Peninsula Borough: The Borough has local government responsibilities for planning, zoning, and solid waste disposal permitting and, as a landowner, must issue a right-of-way for the transportation corridor across borough lands.

The first formal meeting with the agencies was held on December 11, 1984 in Anchorage. Since then, agency involvement has continued via: 1) formal review of the Responsiveness Summary and issue identification process; 2) field visits to the Diamond Chuitna project site; 3) review of a preliminary draft of the DEIS; 4) a July 25, 1985, meeting to discuss the preliminary draft; and 5) informal phone calls among EPA, EIS team members, and agency personnel.

In addition, the Corps and DNR are formal cooperating agencies for the EIS, as provided for in the Council on Environmental Quality Regulations governing preparation of an EIS. As such, the Corps and DNR throughout the EIS process provided technical assistance in their areas of expertise and in matters relating to permits within their jurisdictions.

7.4 PUBLIC INVOLVEMENT

Public meetings were held January 8-10, 1985 as part of the scoping process. In addition, a meeting was held with environmental groups in Anchorage on December 12, 1984. Oral and written comments from the general public and these groups were documented and addressed in the Responsiveness Summary (Table 7-1).

Environmental groups in Anchorage reviewed a preliminary draft of the DEIS and a meeting with those groups was held on July 26, 1985, to discuss the draft. The Native Village of Tyonek (NVT) and the Tyonek Native Corporation (TNC) reviewed a preliminary draft of the DEIS. A meeting was held with representatives of the two organizations in Anchorage on July 26, 1985.

The public may informally submit questions and requests for information or express concern at any time. In addition, public participation opportunities include:

- the formal 60-day period for public review and written comment following publication of the draft EIS.
- public hearings during the draft EIS review period to discuss updated project status, answer questions, and receive comments on the draft EIS. All written comments received during the draft EIS review period will be indivi dually addressed in the EIS.
- a formal review comment period following publication of the final EIS.

Public hearings on the draft EIS were held during August 1988 in Anchorage, Tyonek, and Soldotna. Chapter 10.0 describes the public comments and responses to the DEIS.

7.5 PROJECT INFORMATION CENTERS

Project information and related documents, including the baseline studies, Responsiveness Summary, Table of Contents for the detailed Permit Application to Conduct Surface Mining and the draft EIS, are available for review during normal business hours at the following locations:

Z.J. Loussac Library
3600 Denali Street
Anchorage, Alaska 99503

Kenai Community Library
163 Main Street Loop
Kenai, Alaska 99611

Tyonek Village Community Center
Tyonek, Alaska 99682

Sets of the detailed 27-volume Permit Application to Conduct Surface Coal Mining are at the following locations:

Division of Mining
Dept. of Natural Resources
Eighth Floor
3601 C Street (Frontier Bldg)
Anchorage, AK 99503

Diamond Alaska Coal Company
1227 W. 9th Avenue, Ste. 201
Anchorage, AK 99501

Resource Development Dept.
Kenai Peninsula Borough
147 N. Binkley
Soldotna, AK 99669

Dames & Moore
5761 Silverado Way, Bldg. P
Anchorage, AK 99518-1657

7.6 AGENCY CONTACTS

For additonal information or submittal of questions and concerns relating to the proposed Diamond Chuitna Coal Project or the EPA's EIS, please contact:

EPA

Rick Seaborne
EIS Project Officer
Environmental Evaluation
  Branch (WD-136)
Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101
Telephone: (206)442-8510

EIS Consultant

James E. Hemming
Assistant Project Manager
Dames & Moore
5761 Silverado Way, Bldg. P
Anchorage, AK 99518-1657
Telephone: (907)562-3366

Chapter 8.0

List of Preparers

8.0 LIST OF PREPARERS

U.S. ENVIRONMENTAL PROTECTION AGENCY

Rick Seaborne and William Riley
Diamond Alaska Coal EIS Project Officers

DAMES & MOORE (Third Party EIS Consultant)

Name	Responsibility/Discipline
James E. Hemming, M.S.	Project Manager
J.W. Morsell, M.S.	Wetlands
Michael C.T. Smith, Ph.D. (Terra Nord)	Assistant Project Manager and Wildlife
David E. Erikson, M.S.	Habitat Evaluation
J. Michael Stanley	Geology
Douglas Brewer	Air Quality
Gene R. Andrews, M.S.	Water Quality
L.A. Peterson, M.S. (L.A. Peterson & Associates, Inc.)	Water Quality
Jonathan P. Houghton, Ph.D.	Freshwater and Marine Biology
Jerry C. Wilson, M.S., Ph.D.	Oceanography
David C. Clark, M.A., M.En. (Economic Planning Resources)	Visual Resources and Cultural Resources
Loren Hettinger, M.S., Ph.D.	Vegetation, Soils
Stephen R. Braund, M.A. (Stephen R. Braund & Associates)	Subsistence & Socioeconomics
Nancy Hemming (Falls Creek Environmental)	Report Coordinator, Technical Editor

Chapter 9.0

EIS Distribution List

9.0 EIS DISTRIBUTION LIST

9.1 FEDERAL AGENCIES

U.S. Environmental Protection Agency

Office of Federal Activities, Washington, D.C.
Region VIII, Denver, CO
Alaska Operations Office, Anchorage, AK
Air and Energy Research Laboratory, Research Triangle Park, NC

U.S. Department of the Interior

Office of Environmental Project Review, Washington, D.C.
Regional Environmental Officer, Anchorage, AK

U.S. Fish and Wildlife Service
  State Director's Office, Anchorage, AK
  Alaska Regional Office, Anchorage, AK
  Western Alaska Ecological Services, Anchorage,AK

U.S. Geological Survey, Anchorage, AK

Bureau of Mines, Juneau, AK and Anchorage, AK

National Park Service
  Regional Director's Office, Anchorage, AK
  Lake Clark National Park, Kenai, AK

Alaska Resources Library, Anchorage, AK

Bureau of Land Management
  State Director's Office, Anchorage, AK

U.S. Department of Commerce

National Marine Fisheries Service, Anchorage, AK
  Director's Office, Juneau, AK
Office of Surface Mining, Washington, D.C. and Denver, CO
National Oceanic and Atmospheric Administration, Juneau, AK

U.S. Department of Agriculture

U.S. Forest Service, Juneau, AK
Director's Office
Tongass National Forest, Sitka, AK
Soil Conservation Service, Anchorage, AK
State Conservationist

U.S. Department of Defense

Department of the Army, Alaska District,
Corps of Engineers, Anchorage, AK
District Engineer

U.S. Congress

Honorable Ted Stevens, U.S. Senator
Honorable Frank Murkowski, U.S. Senator

U.S. Department of Health and Human Services

Advisory Council on Historic Preservation,
Washington, D.C.
Indian Health Service, Anchorage, AK

9.2 JOINT FEDERAL/STATE

Alaska Land Use Council

Federal Co-Chairman, Anchorage, AK
State Co-Chairman, Anchorage, AK

9.3 STATE AGENCIES

Office of the Governor

Honorable Steve Cowper, Governor
Division of Governmental Coordination,
Anchorage, AK

Alaska House of Representatives

Honorable F. Kay Wallis

Department of Environmental Conservation

Commissioner's Office, Juneau, AK
Southcentral Regional Office, Anchorage, AK
Division of Environmental Quality Management,
Juneau, AK

Department of Fish and Game

Office of the Commissioner, Juneau, AK
Habitat Division, Anchorage, AK
Game Division, Soldotna, AK and Anchorage, AK
Sport Fish Division, Anchorage, AK

Department of Natural Resources

Commissioner's Office, Juneau, AK
Div. of Land and Water Management, Anchorage, AK
State Historic Preservation Office, Anchorage, AK
Division of Agriculture, Palmer, AK
Division of Geological and Geophysical Survey, Eagle River, AK
Division of Forestry, Anchorage, AK
Division of Mining, Anchorage, AK
Northcentral District Office, Fairbanks, AK
Coastal Coordinator's Office, Juneau, AK

Department of Transportation and Public Facilities

Commissioner's Office, Juneau, AK

Department of Community and Regional Affairs

Division of Community Planning, Anchorage, AK and Juneau, AK

Department of Commerce and Economic Development

Office of the Commissioner, Juneau, AK and Fairbanks, AK

Department of Labor

Commissioner's Office, Juneau, AK

Department of Law

Office of the Attorney General, Juneau, AK

9.4 LOCAL AGENCIES

Tyonek Native Corporation, Anchorage, AK
City of Seward, Seward, AK
City of Kenai, Kenai, AK
City of Soldotna, Soldotna, AK
Kachemak City, Homer, AK
City of Seldovia, Seldovia, AK
City of Homer, Homer, AK

Kenai Peninsula Borough, Soldotna, AK
Arctic Slope Regional Corp., Barrow, AK
Native Village of Tyonek, Tyonek, AK

9.5 MEDIA

Homer Weekly News, Homer, AK
Seward Phoenix Log, Seward, AK
Peninsula Clarion, Kenai, AK
Anchorage Times, Anchorage, AK
Anchorage Daily News, Anchorage, AK

KRXA Radio, Seward, AK
KGTL/KCNL, Homer, AK
KBBI, Homer, AK
KIMO TV, Anchorage, AK
KSKA, Anchorage, AK

9.6 INTERESTED GROUPS AND BUSINESSES

AEIDC, University of Alaska, Anchorage, AK
College of Environmental Sciences, U of A, Fairbanks, AK
School of Mineral Engineering, U of A, Fairbanks, AK
Resource Development Council, Anchorage, AK
Alaska Geological Society, Anchorage, AK
Western Mining Council, Kenai Chapter, Seward, AK
National Audubon Society, Anchorage, AK
Placer U.S. Inc., San Francisco, CA
ENSR, Fort Collins, CO and Anchorage, AK
Kenai Community Library, Kenai, AK
Joyce C. Carver Memorial Library, Soldotna, AK
Yukon Pacific Corp., Anchorage, AK
Coffman Engineers, Anchorage, AK
Exploration Supply & Equipment Inc., Anchorage, AK
Anderson Tug and Barge Co., Seward, AK
U.S. Borax and Chemical Corp., Ketchikan, AK, San Francisco, CA, and Los Angeles, CA
OMD, Fairbanks, AK
Riverside Technology, Inc., Ft. Collins, CO
HWW Consultant, Anchorage, AK
Ott Water Engineers, Inc. Bellevue, WA
Ott Water Engineers, Inc., Anchorage, AK
Alaska Miners Association, Anchorage, AK
Institute of Water Resources, U of A, Fairbanks, AK
Sierra Club, Juneau, AK and Anchorage, AK
Alaska Center for the Environment, Anchorage, AK
Dames & Moore, Seattle, WA
Sierra Club Legal Defense Fund, Juneau, AK and Washington, D.C.

National Wildlife Federation, Washington, D.C.
Seattle City Light, Seattle, WA
Elmer E. Rasmusson Library, Fairbanks, AK
Stone & Webster, Denver, CO
Northwest Mining Assoc., Spokane, WA
Colorado St. Univ. Libraries, Fort Collins, CO
AMAX Exploration Inc., Golden, CO
Z.J. Loussac Library, Anchorage, AK
Alaska Geological Survey, Fairbanks, AK
R.A. Kreig and Associates, Inc., Anchorage, AK
Natural Resources Defense Council, Washington, D.C.
Chugach Alaska Corp., Anchorage, AK
Piledrivers and Divers Local Union 2520,
  Anchorage, AK
Kiewit Mining and Engineering, Sheridan, WY
Terra Nord, Anchorage, AK
Pacific Coast Coal Co., Black Diamond, WA
Trustees for Alaska, Anchorage, AK
Kerr McGee Coal Corp., Oklahoma City, OK
Chugach Electric Assoc., Anchorage, AK
Union Pacific Minerals, Westminister, CO
Specialty COnsultants Group, Redmond, WA
Resource Economics, Anchorage AK
Fluor Daniel Alaska, Inc., Anchorage, AK
Woodward-Clyde Consultants, Anchorage, AK
RDC, Anchorage, AK
Riverside Technology Inc., Ft. Collins, CO
Pacific Coast Coal Co., Black Diamond, WA
ERT, Inc., Anchorage, AK
HWW COnsultants, Anchorage, AK

9.7 INTERESTED CITIZENS

Pat Chuitt, Tyonek, AK
Wayne McCord, Tyonek, AK
Robert Freeman, Beluga River, AK
Seraphim Stephan, Sr., Tyonek, AK
Mr. Kroto, Tyonek, AK
Peter Merryman, Tyonek, AK
Willard McCord, Jr., Tyonek, AK
Don Standifer, Tyonek, AK
Ken McCord, Tyonek, AK
Dave Haugen, Anchorage, AK
Bruce Roberts, Chugiak, AK
Ron Wild, Chugiak, AK
Lee M. Carlson, Anchorage, AK
Robert Britch, Anchorage, AK
W.M. George, Anchorage, AK
Kathleen Hayes, Girdwood, AK
Sharon Wild, Chugiak, AK

Anne Leggett, Anchorage, AK
Rod Chervas, Anchorage, AK
Ginger Steffy, Soldotna, AK
Cynthia L. McCord, Tyonek, AK
Michael Miller, Anchorage, AK
Thomas Brown, St. Louis, MO
Mira Starkloff, Tyonek, AK
Becky Gay, Anchorage, AK
Gloria Gill, Anchorage, AK
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Donald F. Lynch, Fairbanks, AK
Ike Waits, Anchorage, AK
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Willard E. Dunham, Seward, AK
David Ramseur, Washington, D.C.
P.D. Rao, Fairbanks, AK
Ronald A. Garzini, Seward, AK
Jess L. Hall, Kenai, AK
Floyd Heimbuch, Soldotna, AK
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Thomas Brown, St. Louis, MO
Michael Miller, Anchorage, AK

Chapter 10.0

Public Response to DEIS

10.0 PUBLIC RESPONSE TO DEIS

10.1 Introduction

Public hearings on the Diamond Chuitna Coal Project draft DEIS were conducted by EPA in Alaska during August 1988. Specific dates and locations were: Anchorage (August 17, 1988), Tyonek (August 18, 1988), and Soldotna (August 19, 1988). Testimony was presented at the Anchorage and Tyonek hearings; no testimony was presented at the Soldotna hearing.

The hearing officer for all three hearings was Mr. Rich Sumner of EPA Region 10. Each hearing was opened by Mr. Sumner, who explained the NEPA and EIS process. Mr. Rick Seaborne, the Diamond Chuitna EIS project officer for EPA, then described the proposed project and the DEIS. Following these introductions, public testimony was taken. Transcripts of each hearing were kept and are available from:

Mr. Rick Seaborne
U.S. Environmental Protection Agency
Environmental Evaluation Branch, M/S WD-136
1200 6th Ave.
Seattle, Washington 98101

Testimony presented at the public hearings included support for the project by both the Municipality of Anchorage and the Archdiocese of Anchorage, a request to include a recent Kenai Peninsula Borough planning document in the EIS, concern by Tyonek residents that the existing dock at the North Forelands be considered for coal transportation, and concerns regarding the effects of offshore facilities on commercial fishing, and the effects of the project on area residents.

Written comments were received from seven individuals and organizations:

1. U.S. Department of the Interior, Office of Environmental Project Review (Department of the Interior Agencies)

2. U.S. Army Corps of Engineers, Alaska District

3. State of Alaska, Division of Governmental Coordination (State of Alaska Agencies)

4. Beluga Coal Company

5. Tyonek Native Corporation

6. Trustees for Alaska

7. Ms. Tamara Smid

The following is a list of the primary concerns raised at the DED public hearings and in written comments received during the DEIS public review period. Each comment and response is summarized in Section 10.2. Section 10.3 contains copies of written comments.

- Detailed information on the Ladd port site, eastern and northern transportation corridors is lacking.
- The North Forelands port site should not be eliminated.
- Mitigation chapter needs revision.
- Air quality analysis is not adequate. Special attention should be given to use of dust suppressant chemicals, fugitive dust from truck hauling, and enclosure of the conveyor.
- The water quality discussions need attention, especially sections dealing with location of sewage outfalls and burial of sludge, mixing zones, and the draft NPDES permits. The information contained in the EIS should be updated per current Alaska water quality standards.
- Concern still exists regarding the effect of the project on subsistence resources.
- Information in the EIS needs to be updated per the Alaska surface coal mining permit, especially sections dealing with revegetation, reclamation, soil, and topsoil.

10.2 Response to Public Comments

This chapter summarizes the comments received during the public comment period for the DEIS. These include both written and oral comments. Responses to each comment are provided after the respective comment summary. In some cases, the comment has resulted in a change to the text. The locations of these changes are indicated in the appropriate comment response. Please note that the comment summaries reference page numbers from the DEIS, not the FEIS.

- **Paul D. Gates** Office of Environmental Projects Review (DOI)

Comment

1. EIS should have specific ground-water monitoring plans.

Response

Applicant initiated baseline ground-water monitoring in 1982 which has continued to the present. These plans are referenced in Chapter 6.0 of the FEIS. ASMCRA Volume XVII, pages 4-232 through 4-237 discusses pre-operational and operational ground-water monitoring. Pre-operational monitoring will be implemented upon the commencement of construction and will phase into operational monitoring. Monitoring well locations appear in Map 4.12-31 (ASMCRA permit application). All wells will be monitored semi-annually for water quality. These wells are in alluvium, at springs, in the overburden, Blue Coal, Red 3 Coal, Red 2 Coal, Sub-R2 Sand, Red 1 Coal, and Sub Red 1 Sand formations. Water quality parameters include:

Total Dissolved Solids
pH
Conductivity
Temperature
Total Suspended Solids
Turbidity
Total Hardness
Calcium
Magnesium
Sodium
Potassium
Ammonia-N
Total Alkalinity
Bicarbonate
Carbonate
Hydroxide
Chloride
Fluoride
Kjeldahl-N
Nitrate + Nitrite-N
Sulfate
Ortho-phosphate-P
Total Phosphorus-P

Aluminum
Antimony
Arsenic
Beryllium
Boron
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium
Silica
Silver
Titanium
Zinc
Phenol
Total Organic Carbon

Comment

2. Map faults that affect ground-water flow and discuss effect on aquifers.

Response

Faults added to Figure 2-4 in the FEIS. Effects on aquifers is discussed in Section 4.4.1 and 5.3.2.1 of the FEIS.

Comment

3. Ladd Port site is not described in as much detail as Granite Point. Must be studied and quantified (HEP or other).

Response

The configuration of the Ladd port site, i.e., facilities and their layout, would be similar to that described for the Granite Point port site. Figures 2-12 and 2-13 are generic and apply to either port site. Additional baseline environmental information for the Ladd port site has been added to Chapter 4.0 of the FEIS.

Comment

4. No comprehensive mitigation plan for each alternative.

Response

The mitigation plan included in the project proposal consisting of mitigation measures committed to by the applicant for all project components, is discussed in Chapter 2.0. The discussion of environmental consequences (Chapter 5.0) has taken these mitigation measures into account. Chapter 6.0, which has been substantially revised, summarizes the detailed mitigation, reclamation, and monitoring requirements imposed by the State of Alaska through the Alaska Surface Coal Mining Program and other permitting programs; requirements of federal and local permitting programs; and other measures which could be considered by the permitting agencies. Measures pertaining to road construction or construction of the port sites are applicable to any route or location chosen. Many site-specific details will be handled in individual agency permits.

- **Larry Reeder U.S. Army Corps of Engineers (Anchorage)**

Comment

1. Mitigation must be treated more fully. Mitigative measures in the text must be listed separately (reducing, avoiding, minimizing). Also, list mitigative requirements from the Division of Mining permit stipulations.

Response

See response to DOI comment #4, above. Also, Chapters 2.0 and 3.0 discuss mitigative measures which avoid, reduce, or minimize potential adverse impacts which might occur as a result of this project.

Comment

2. The detail of Ladd corridor development is not on the same level as the others.

Response

Additional information on the Northern/Ladd corridor is included in this document, e.g., baseline environmental studies (Chapter 4.0) and preliminary engineering (Chapter 2.0 and 5.0) for the road.

Comment

3. Draft 404 (b) (1) evaluation developed by Dames & Moore left out of Appendix C.

Response

Draft 404 (b) (1) evaluation has been included in FEIS.

- **Patty Bielawski** Division of Governmental Coordination, State of Alaska

Comment

1. DEIS team should review the technical evaluation done by State of Alaska during Phase I permitting and incorporate the monitoring and mitigation developed for the mine component's first 10 years.

Response

Chapter 6.0 of the FEIS has been substantially rewritten and includes State of Alaska permitting, monitoring, and mitigation.

Comment

2. Not enough information regarding mixing zone in receiving water.

Response

See added paragraph in Section 2.3.3.1 of the FEIS. Mixing zones for turbidity are referenced in the proposed final NPDES permit or the mine area included in Appendix D of this FEIS, subject to 401 certification by ADEC.

Comment

3. Mitigation to be adopted by applicant and supported by EPA is unclear.

Response

See Chapter 2.0 and revised FEIS Chapter 6.0. See also responses to DOI comment #4 and ACE comment #1 above. Mitigation measures are required in the state mining permit, other state permits, EPA, and COE permits.

Comment

4. Mitigation should be formulated by a federal/state/ applicant forum.

Response

A federal/state/applicant meeting was held 11/1/88 to discuss mitigation. The agencies subsequently reviewed the revised Chapter 6.0 (Mitigation, Reclamation, and Monitoring) and the preliminary FEIS.

Comment

Page S-2
5. Conveyor should be covered on all sides; not just at stream crossings.

Response

The conveyor is covered by a dome-shaped top and on the windward side to prevent wind dispersion of coal and fines from the belt. One side is left open below the belt to allow visual inspection and maintenance access to the rollers and the belt. Coal and fines cannot pass through the belt to fall under the conveyor. However, as an added level of safety, "pans" are put under the conveyor at stream crossings. At an unusually sensitive area such as the Chuitna River crossing, the conveyor is completely enclosed for maximum safety.

Comment

Page 2-9

6. FEIS should address the necessity of a mixing zone to meet Alaska Water Quality Standards.

Response

Paragraph added to Section 2.3.3.1 discusses the applicability of mixing zones. Mixing zones for turbiditiy are referenced in the permit for the mine area which is included in Appendix D of this FEIS subject to 401 certification by ADEC.

Comment

Page 2-14, Fig. 2-4

7. Figure and statements regarding treatment systems for sediment ponds should be revised per state's stipulations.

Response

Figure 2-4 of the FEIS has been revised. Wording added to Section 2.3.5 of the FEIS per ASMCRA stipulations.

Comment

Page 2-15

8. Figure 2-7 and Figure 2-10 do not agree regarding buried moose crossings on bluffs at Chuitna River crossing.

Response

The crossing shown on Fig. 2-7 (DEIS and FEIS) is just outside the area shown in Fig. 2-10. The map scales of the map and the artist's conception differ from one another.

Comment

Page 2-16, Fig. 2-8

9. Gravel sources must be more clearly delineated and explanation provided regarding why they are the best locations.

Response

Material sites have been selected on the basis of the gravel available and proximity to areas where gravel is needed. Further delineation will be provided in the state lease process prior to gravel extraction.

Comment

Page 2-19

10. "Partially enclosed" conveyor needs further explanation.

Response

See response to comment 5 pertaining to page S-2.

Comment

11. Distance or design criteria established for southern corridor cannot necessarily be transferred to other corridors. (related to buried animal crossings)

Response

The criteria for moose crossings for the southern corridor are consistent with criteria established for crossing designed elsewhere in Alaska (see Van Ballenberghe 1977; Eide and Miller 1979). Therefore, the criteria can be applied to the northern or eastern corridor as well. The Diamond Chuitna project would provide crossings at a frequency of about 1.7 per mile plus all stream crossings. Moose crossing structures were set at an average of one per mile on the trans-Alaska oil pipeline; it was demonstrated that moose passage was achieved. Adjusting the location of specific crossings to coincide with existing moose trails on all road and conveyor alternatives would provide even better accommodation of seasonal moose movements. Detailed wildlife utilization patterns will be confirmed by the wildlife monitoring program during the first two years of road operation.

Comment

Page 2-25, 2-44

12. Document should reference fuel handling standards, i.e., 100% of capacity of largest tank and 12" of freeboard.

Response

The Spill Prevention, Control and Countermeasure (SPCC) plan will be written to incorporate federal and state fuel handling standards. New wording added to Section 2.10.3 of the FEIS.

Comment

Page 2-27

13. Burial of sludge requires coordination with ADEC regulations regarding stabilization.

Response

Noted.

Comment

Page 2-30

14. Paragraph 6, statement regarding covering unsuitable soil should be removed. (per DACC agreement with state)

Response

Wording removed from Section 2.8.1.1 of the FEIS.

Comment

Page 2-34

15. Why is the fish mitigation plan and not the wildlife plan discussed here?

Response

Mitigation measures pertaining to wildlife are found throughout Chapter 2.0, but appear primarily in the discussions of revegetation, reclamation, and the transportation system. Chapter 6.0 also discuss mitigation measures for wildlife. Mitigation measures for fish are listed separately in Chapter 2.0 because it was more convenient to present the information in a tabular form in one place in the chapter.

Comment

Page 2-39, 2-41

16. Cleared trees must be peeled and stacked for the first 2 years to prevent beetle infestation before burning in the mine pit can commence.

Response

Trees susceptible to spruce bark beetles will be limbed and left in non-shady locations for no more than 1 year before being buried or burned.

Comment

Page 2-41

17. Mitigation and erosion control after clearing conveyor corridor must be discussed.

Response

Additional wording has been added to Section 2.9.3.2 to indicate that ground cover will be left in place where feasible to provide erosion protection. Revegetation is discussed in Section 2.8 and 2.9.3.2.

Comment

Page 2-46

18. Paragraph 4; Chemical dust suppressants must be identified as well as environmental considerations.

Response

Chemical dust suppressants to be used will be magnesium chloride or calcium chloride. It is anticipated that they will be used only when rainfall or application of water is insufficient, probably only once or twice a year. Effects on aquatic and terrestrial resources are expected to be negligible.

Comment

Page 3-6

19. FEIS should recommend against long term truck hauling of coal due to effects on wildlife and air quality.

Response

Chapter 3.0 of the DEIS analyzes a number of project component options, including optional methods for transporting coal from the mine to the port site. The comment refers to one of these options, which would entail the use of haul trucks to transport coal throughout the life of the project. The adverse impacts to wildlife and air quality that would occur if haul trucks were used to transport coal to and from the port site at full production are discussed in the DEIS (pages 3-17 to 3-21).

This option, which would include 311 round trips per day by haul trucks at full production, was eliminated from further consideration as discussed in Chapter 3.0 and is not proposed nor considered as an alternative in the DEIS.

The proposed project, as analyzed in Chapter 5.0 entails construction of a coal conveyor which would be used to transport the coal to the port site. The DEIS analyzes the air quality impacts associated with 99 round trips by haul trucks (to and from the port site) per day. This is the maximum number of trips predicted during the period the conveyor is being constructed (at a production of 4 million tons per year). The conveyor would subsequently be used to transport coal to the port up to the maximum production level of 12 million tons per year.

As stated on page 5-53 of the DEIS, construction and temporary emissions must comply with the National Ambient Air Quality Standards but are exempt from the Prevention of Significant Deterioration (PSD) increments. These would include fugitive dust emissions from the haul road during this period the conveyor is being constructed.

Comment

Page 3-13

20. Weighing wildlife impacts on basis of acreage removed is simplistic: Attention should be paid to location and orientation of migration pathways, critical habitat, etc. to conveyor and roads.

Response

Wildlife impacts were weighed on the basis of several factors including direct habitat removal, quality of habitat, indirect habitat loss, and effect on animal movements as stated in Section 5.3.1.5 and Appendix A.

Comment

Page 3-16

21. No data to support conclusion that effect of Northern/Ladd option on animal movements would be moderate.

Response

The effects of both the Northern/Ladd and Eastern/Ladd option were judged to be moderate because both routes are generally at right angles to major large animal movements at lower elevations. Right angle crossings are generally considered to be less disruptive than routes which parallel animal migrations. The planned frequency of special wildlife crossings (nearly 2 per mile) is greater than applied on the trans-Alaska oil pipeline. Impacts to wildlife movements as a result of TAPS was minimal. Bear and moose are likely to encounter the Northern/Ladd and Eastern/Ladd routes more often than they would the Southern/Granite Point route. However, with adequately designed and spaced large mammal crossings, the differences between these options would be minimal.

Comment

Page 3-19

22. Applicant hasn't committed to building moose crossings along the conveyor route to Ladd. Must reference this as mitigation.

Response

The applicant has committed to building moose crossings at stream crossings and other locations along the road and conveyor system for the southern, eastern and northern corridors. See Section 2.4.2 of the FEIS.

Comment

Page 3-33/35

23. FEIS must explain what applicant will do if NEPA preferred alternative and ROD differ from applicant's proposal regarding the conveyor/transportation route.

Response

All three alternative transportation routes, including the "northern/Ladd", "eastern/Ladd", and "southern/Granite Point" routes, were compared in Chapter 3.0 of the DEIS. The "preferred alternative", as designated in the DEIS and FEIS, incorporates the eastern/Ladd transportation route. Because the applicant has been unable to negotiate a right-of-way agreement for this route the two remaining alternative corridors (northern/Ladd, and southern/Granite Point) were directly compared to determine which of these two routes were preferable if eastern/Ladd were not developable. To eliminate possible confusion over the use of the term "secondary preferred alternative" (pages S-9 and 3-34 of the DEIS), this term has been eliminated from use in the FEIS. This does not in any way alter the comparative evaluation of the alternatives or conclusions leading to designation of the preferred alternative.

EPA and the Corps will issue separate Records of Decision (RODs) subsequent to issuance of the FEIS. A brief description of factors considered in RODs is provided on page 1-2 of the DEIS. Alternative permitting decisions available to the agencies are described on page 3-39 of the DEIS. The final EPA and Corps permit decisions will be made after the FEIS is issued and will be reflected in the respective RODs. The RODs will discuss the alternatives analyzed in the EIS and will designate an "environmentally preferred alternative".

With respect to the Diamond Chuitna project alternatives, EPA's ROD will indicate EPA's final NPDES permit action with respect to the two alternative port sites (Granite Point and Ladd). EPA's permit action could entail either the granting of an NPDES permit (for either port) or denial of the permit. The Corps' Section 10/404 permitting authority extends to both the ports and the transportation corridors. The Corps' permitting decisions respective to these project components will be reflected in the Corps ROD.

The environmentally preferred alternative, as designated in the agency RODs, may or may not be the alternative for which permits are granted. The RODs will include a discussion of any factors that were considered in making the permit decisions, taking into account the agency's statutory missions, economics, and feasibility questions. The RODs will also state what means to avoid or minimize environmental impacts were adopted through the permit actions, and the rationale.

Comment

Page 4-1

24. Paragraph 3: Moquawkie Indian Reservation was established in 1915, not 1934.

Response

Text has been corrected on p. 4-1 of the FEIS.

Comment

Page 4-17

25. Paragraph 2: Statement in first sentence must be expanded to explain that the Lone Ridge moose population is not small. Rut concentration has not been adequately explained. Also, reference fact that very little information regarding Lone Ridge rut concentration exists.

Response

See revised paragraph in Section 4.3.3.2 of the FEIS.

Comment

Page 4-29

26. Explain how floods of Oct.'86 compare to maximum recorded flood in Sept.'76.

Response

Section 4.4.2.4 of the FEIS has been revised to reflect this new data.

Comment

Page 4-65

27. Paragraph 3: KPB is classified as "non-rural" indicating that subsistence is not a major part of economy. Subsistence is only important in certain areas, not whole KPB.

Response

Wording changed to clarify paragraph in Section 4.7.1.2 of the FEIS.

Comment

Page 4-89

28. Paragraph 2: Winter moose hunt was subsistence and recreational from 1983 to 1985; it is now subsistence only.

Response

Wording added to paragraph in Section 4.10.2 of the FEIS.

Comment

Page 5-11

29. Direct loss of moose can occur from moose/vehicle collisions.

Response

Section 5.3.1.5 addresses only the mine and mine facilities; most moose/vehicle collisions would occur in the transportation corridors.

Comment

Page 5-19
30. If proper construction and materials are used, ground water should not be degraded by leakage from sewer lines and sewage treatment plant. "Somewhat poorer" water quality resulting from mining should be more fully explained, ref. ASMCRA permit application Vol. XVII.

Response

Reference deleted from Section 5.3.2.1 of the FEIS. Wording added to Sections 5.3.2.1 and 5.6.1.2 of the FEIS per ASMCRA.

Comment

31. Mention possibility that natural stream temperatures and icing conditions could be modified by mine development.

Response

See response to Smid comment #7. Temperature changes are expected to be less than 1° C from normal in the winter. Icing changes with this small temperature change are expected to be minimal.

Comment

Page 5-20
32. Surface water runoff in developed areas must meet Alaska Water Quality Standards; how will this be accomplished in areas outside the ASMCRA permit area?

Response

Proposed treatment of surface runoff outside ASMCRA area is reflected in the draft NPDES permits for the port alternatives and housing area (Appendix D). At the port sites and the housing facilities, runoff water will be collected in sediment ponds. The discharge from these ponds must meet state requirements. In areas of road construction, runoff will be controlled by: a) good construction practices, b) good erosion control practices, (e.g., sediment fences, revegetation, etc.), and c) minimization of surface disturbance as described in Sections 2.4, 2.5, and 2.6 of the FEIS.

Comment

Page 5-25, 5-35

33. Discussion concerning water quality standards must be expanded.

Response

Discussion has been expanded; see section 5.3.2.3.

Comment

Page 5-28

34. The most stringent water quality standards apply. Oil and grease must be addressed here.

Response

This section is a discussion of EPA criteria for discharges from sediment ponds (i.e., federal effluent limitations as opposed to State of Alaska receiving stream criteria). The NPDES effluent limitation for pH is 6.0 to 9.0 (Appendix D) as stated in Section 5.3.2.3. Oil and grease limitations have been added to Section 5.3.2.3.

Comment

Page 5-30

35. Mixing zones must be addressed as well as water quality contingency plan required by state.

Response

Wording added to Section 5.3.2.3 (General Criteria) of the FEIS regarding mixing zones and compliance. The state water quality contingency plan is an ASMCRA requirement and is discussed in Section 6.2.1.1 of the FEIS.

Comment

Page 5-31, 5-34, 5-81

36. Discrepancy between table 5-8, 5-9, and 5-25 and the standards. Also levels of hydrocarbons, oil and grease, turbidity and settleable solids are not included.

Response

The commentor cites information from EPA's Quality Criteria for Water 1986 (Gold Book) regarding chronic "criteria" for arsenic and copper. The concentrations cited are from a table entitled, "Water Quality Criteria Summary." However, the concentrations cited (as noted in this table) are "lowest observed effect level" (LOEL) values. LOEL values are not necessarily the criteria because these values are species specific. Furthermore, states are allowed to interpret information in EPA publications to derive specific criteria. In this case, the values cited by the commentor are not the Alaska criteria. This becomes apparent if one reads the text of the Gold Book rather than relying on the Water Quality Criteria Summary table. Using arsenic, for example, the commentor states that fresh water and marine water chronic criteria for arsenic are 48 and 5 ug/l, respectively. The commentor fails to note these values are only for arsenic (V). Regarding fresh water, the Gold Book states, "Not enough data are available to allow derivation of numerical national water quality criteria for freshwater aquatic life for inorganic arsenic (V)... Arsenic (V) affected freshwater aquatic plants at concentrations as low as 48 ug/l."

Also, corrections have been made on Tables 5-8, 5-9, and 5-25 in the FEIS. The parameters listed in Tables 5-8, 5-9, and 5-25 are based on all the available information at the time the DEIS was written. At that time, it was anticipated that coal leachate presented the highest potential for degrading receiving stream water quality. Therefore, these tables include all the parameters analyzed in Diamond Alaska Coal Company Column and Drip Leach Study performed by Bookcliffs (1985). Although turbidity and settleable solids were not measured in this study, total suspended solids were and appear in the tables. Hydrocarbons and oil and grease were also not measured in the Bookcliffs study. It should be noted that the EPA criteria for oil and grease have been added to Section 5.3.2.3 Surface Water Quality, General Criteria.

Comment

Page 5-32

37. DEIS does not specify if, how and what flocculants will be used.

Response

Additions made to Section 5.3.2.3 of the FEIS, "Mine Site Runoff" and "Pit Drainage". Several flocculants have been tested using soils from the mine site. The flocculants (polyethylene oxide, lime, ferric chloride and ammonium sulfate) all performed well under certain conditions. The choice of which will be used depends on the nature of suspended solids. This will vary in different areas and stages of the project. The choice of an individual flocculent will depend on actual field data obtained during construction and operation.

Comment

Page 5-33
38. DEIS should reference applicant's commitment to pump only from in-pit sumps when discharge can meet Alaska Water Quality Standards.

Response

Addition made to Section 5.3.2.3, "Pit Drainage" of the FEIS.

Comment

Page 5-69
39. Paragraph 1: Discuss all potential effects of subsistence in one section.

Response

The document is organized so that the effects of each project component on subsistence is discussed separately. Therefore, the entire subsistence discussion is not consolidated under Section 5.3 which deals only with the mine and mine area. References to following sections have been inserted in Section 5.3 of the FEIS.

Comment

Page 5-69
40. Paragraph 4: DEIS prediction of no drastic decline in moose abundance is unsubstantiated. Reference state monitoring program.

Response

Section 5.3.7.2 of the FEIS has been reworded.

Comment

Page 5-80

41. State standards do not allow ground-water mixing; this section should be rewriten.

Response

See additional wording in Section 5.4.1.2 of the FEIS. Also, the commentor is correct regarding the use of ground-water dilution to achieve water quality standards. The intent of this narrative was to explain that some parameters may periodically exceed their criteria for the protection of aquatic life as the water infiltrates toward the ground-water table. Even if this water resurfaces before reaching the ground-water table, the volume of seepage into a stream or lake would be low, resulting in no adverse impacts to aquatic life.

Comment

Page 5-85

42. Effect of sediment loading on Cook Inlet due to this project must be addressed.

Response

This comment was directed to Section 5.4.1.2 but should have been directed to Section 5.4.1.3, Marine Water Quality. See additional wording in Section 5.4.1.3 of the FEIS.

Comment

Page 5-86

43. Use and disposal of solvents in repair and maintenance shops is not addressed.

Response

See additional wording in Section 5.4.1.2 of the FEIS. Oil and grease traps at the mining facilities are designed to handle the full anticipated output with a large safety factor added. In addition, oil skimmers at the ponds would be used if the traps malfunctioned.

Comment

44. Removal of oil and grease from sediments if trap fails or inadequate operation is not addressed pounds.

Response

See additional wording in Section 5.4.1.2 of the FEIS regarding installation of skimmers and disposal of oily waste.

Comment

Page 5-114
45. Further review of ground-water effects is needed for housing leach field.

Response

This subject will be addressed in the ADEC permitting process.

Comment

Page 5-115
46. Table 5-27 omits important water quality parameters.

Response

Table 5-27 has been amended in the FEIS. In addition, the commentor notes that Table 5-27 did not include TSS, dissolved oxygen (DO), fecal coliform, or chlorine. The proposed final NPDES permit (Appendix D) has limits on BOD, TSS, and pH. Therefore, TSS have been added to the table; pH is included in the proposed final NPDES permit.

DO concentrations in the effluent will not be low enough to cause an adverse oxygen demand on the Chuitna River. Assuming the discharge is at room temperature means there could easily be 8 to 9 mg/l DO in the effluent. Furthermore, the BOD concentration of 19 mg/l will not create a large enough oxygen demand in the river to significantly reduce ambient DO levels in the river. Recall that BOD is exerted over 5 days at optimum conditions and these conditions will not exist in the river.

Fecal coliform bacteria levels in domestic waste discharges are a function of the adequacy of disinfection techniques. Chlorine is commonly used for disinfection. A chlorine residual of 0.1 mg/l is commonly maintained. Secondary waste treatment package plants and a trained operator will result in less than 200 fecal coliform colonies per milliliter (the EPA limit for domestic waste) being discharged. The expected chlorine concentration in the effluent will be approximately 0.1 mg/l.

Comment

47. Data and justification for mixing zone is not provided.

Response

See response for comment 82 below.

Comment

Page 5-116
48. Move subsistence discussion to 5-69.

Response

See response for comment 39 above.

Comment

Page 5-117
49. Agree that restrictive harvest regulations could affect Tyonek's subsistence opportunities.

Response

Noted.

Comment

Page 5-123
50. Paragraph 2: In mild winters, moose also use habitat near Congahbuna Lake.

Response

Noted in Section 5.6.2.1 of the FEIS; Section 5.6.3.1 refers to Threemile housing site, not Congahbuna.

Comment

Page 5-125
51. Include all subsistence discussion in one section.

Response

See response for comment 39 above.

Comment

Chapter 6.0
52. Further definitions of "increased" and "decreased emphasis" regarding mitigation are required.

Response

Reference to "increased" and "decreased emphasis" have been removed from Chapter 6.0..

Comment

Page 6-4
53. Citation should be changed to 11 AAC 90.311 (e).

Response

Chapter 6.0 of the FEIS has been substantially rewritten; to reflect the final ASMCRA permit requirements.

Comment

Page 6-3/4
54. DEIS does not reflect final surface mining permit stipulations regarding soils.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMRCA permit requirements regarding soils.

Comment

Page 6-5
55. Revegetation discussion should be revised to reflect plan in the Permit Application (Vol. XVI).

Response

Chapter 6.0 of the FEIS has been revised to reflect final ASMCRA permit requirements regarding revegetation.

Comment

Page 6-6
56. Incorporate wildlife mitigation plan from surface mining permit.

Response

Wildlife plan from ASMCRA permit is discussed in revised Chapter 6.0 of the FEIS.

Comment

57. Paragraph 2: Performance standards for reclamation success have been established in the surface mining permit.

Response

ASMCRA permit has been referenced in revised Chapter 6.0 of the FEIS.

Comment

Page 6-7

58. Paragraph 2: FEIS should specify standards for habitat enhancement.

Response

The FEIS (Section 6.4.1.2) recommends that habitat enhancement measures similar to that within the ASMCRA area be employed for areas outside the boundary. The reader is referred to Chapters 2.0 and 6.0 for further discussions of specific measures outside the ASMRCA permit area.

Comment

59. Paragraphs 3, 4, & 5: Conveyor access road should be regularly cleared of snow to encourage moose to use it rather than haul road.

Response

The conveyor access road will be continually cleared of snow since there must be a visual inspection of the conveyor every shift (3 to 4 times daily).

Comment

60. Paragraph 6: Include documentation regarding plastic balls on cables and other methods of keeping birds from striking cables and wires.

Response

Reference to plastic balls has been removed from Chapter 6.0 of the FEIS.

Comment

Page 6-8

61. Paragraph 4: Proposal that return flows to streams be managed to optimize down stream flow conditions was rejected in surface mining permit.

Response

Chapter 6.0 of the FEIS has been revised to reflect ASMCRA permit.

Comment

Page 6-9

62. Paragraph 2: A wetland restoration plan was required under the surface mining permit.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

63. Paragraph 3: Reference commitments regarding restoration of mined out stream systems in Permit Application (Vol. XVII).

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

64. FEIS should recommend reclamation of mined out streams as mitigation for loss of fish habitat in areas to be mined in years 11 through 30 of the operation.

Response

Section 6.4.2.3 of the FEIS makes this recommendation.

Comment

65. Detailed engineering designs for stream reclamation should be distributed to interagency forum as soon as available.

Response

Noted. This will be handled through state agency permitting process.

Comment

Page 6-10
66. Paragraph 2: Mitigation plans for sediment ponds are found in surface mining permit.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

Page 6-11
67. Paragraph 3: A mitigation program to compensate for unavoidable loss of fish productivity is required by surface mining permit (Stip. 14).

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

Page 6-14
68. Paragraph 1: See Vol XVI for soil monitoring plan.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

Page 6-14
69. Paragraph 2: Annual revegetation monitoring required under surface mining permit.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

70. Paragraph 3: Additional monitoring recommended to determine success of habitat enhancement, crossings of conveyor, effects on Beluga moose population.

Response

ADF&G will conduct a 3 year telemetry study beginning 2 years prior to mine construction, supplemented by aerial population surveys. Fall trend counts will help evaluate the success of moose crossings, moose rutting activity, and habitat use.

Comment

71. Paragraph 4: Surface mining permit requires continuous flow monitoring at 7 locations (Stip. 18).

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

Page 6-15

72. Paragraph 1: ASMCRA permit (Stip. 17) requires annual evaluation of ground- and surface water monitoring programs.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

73. Paragraph 2: ASMCRA permit requires extensive ground water monitoring program.

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

74. Paragraph 3: SMP requires extensive monitoring of water quality of effluents from mine drainage system and receiving streams (Permit Application Vol. XVII).

Response

Chapter 6.0 of the FEIS has been revised to reflect the final ASMCRA permit requirements.

Comment

Page 6-16
75. Paragraph 4: ASMCRA permit addresses all the points raised in the DEIS.

Response

FEIS has been revised to reflect ASMCRA permit. ASMCRA covers only mine area; EIS has wider geographic coverage.

Comment

76. Clarification of socioeconomic coordination is required.

Response

Section 6.4.5 of the FEIS has been revised.

Comment

Page 7-7
77. Correct DACC address.

Response

Corrected in Section 7.5 of the FEIS.

Comment

Page 11-8
78. Correct Fall, Foster, Stanek reference title.

Response

Corrected in Chapter 11.0 of the FEIS.

Comment

Appendix C

79. Mixing zone must be discussed as well as contingency plan for sediment pond discharges.

Response

The Corps of Engineers public notice would include mixing zones only if they pertain to the discharge of fill material. Sediment pond discharges would not be covered by the COE permit.

Comment

Appendix D

80. Mixing zone must be discussed as well as contingency plan for sediment pond discharges.

Response

Mixing zones have been discussed in Section 2.3.3.1 of the FEIS. The applicable mixing zone for turbidity have been approved by ADEC and are addressed in the proposed final NPDES permit for the mine area (Appendix D). A conceptual water quality contingency plan has also been approved by ADEC. The final plan will be approved per ASMCRA permit requirements. The proposed final NPDES permits are subject to 401 certification and coastal consistency review by the State of Alaska. See response for DGC comment #86 below.

Comment

Appendix D

81. A hydrocarbon limit is appropriate if oil and grease levels are 10-15 mg/l.

Response

A total hydrocarbon limit of 0.15 mg/l has been substituted for the oil and grease limit for those discharges which contain runoff from equipment washdown or maintenance areas. These discharges are:

Ladd Port Site (AK-004685-0), outfall 001
Granite Port Site (AK-004331-1), outfall 002
Mine Site (AK-004357-5), outfalls 017 and 018

The total hydrocarbon limit is based on the Alaska Water Quality Standards, 18 AAC 70.020. The method for analysis (Standard Method 5038) has also been specified.

Comment

82. Limitations on flow, fecal coliform and chlorine should be set for all sanitary waste discharges.

Response

NPDES permits for the Granite Point Coal Port (AK-004331-1) outfall 001, and the Housing Facilities (AK-004356-7) outfall 001 authorize the discharges of sanitary waste. These permits now include maximum flow limitations based on the capacity of the treatment plant. For the port site, the treatment plant's average monthly flow limitation is 2,000 gallons per day (gpd). For the housing site, the treated sanitary waste from the mine site (previously identified as outfall 019 in the mine permit) and the Lone Creek housing site will be combined before discharge. This combined flow is 50,000 gpd.

Fecal coliform standards have been established in the state's water quality standard regulations (18 AAC 70). Discharges of sanitary waste authorized by the Housing Facilities permit is to the Chuitna River, which is protected for all fresh water uses. The most stringent fecal coliform criteria is 20 fecal coliforms (FC) per 100 milliliters (ml) based upon 5 samples taken in a 30 day period, and not more than 10 percent of the total samples shall exceed 40 FC/100 ml.

The port site discharge is to Cook Inlet, which is protected for all marine water uses. The most stringent fecal coliform criteria for marine water uses is calculated by using the most probable numbers (MPN) procedure for measuring fecal coliform. The median MPN shall not exceed 14 FC/100 ml, and not more than 10 percent of the samples shall exceed a FC MPN of 43 FC/100 ml.

Both the fresh water and marine water FC criteria must be met at the edge of the mixing zone. ADEC will, through the Clean Water Act 401 certification procedures, establish "end of the pipe" fecal coliform and chloride limitations.

Comment

83. References to "trace amounts" of floating solids, visible foam and oil and grease should be removed.

Response

Changes have been made in all NPDES permits.

Comment

84. Regulation of chemicals and detergents used to wash equipment must be addressed.

Response

The Ladd Coal Port, Granite Coal Port and Mine NPDES permits will now require the permittee to submit to EPA and ADEC a list of those chemicals, detergents, and solvents/degreasers that are used to wash down equipment or used in the maintenance shops and enter the sedimentation ponds through runoff. Only those chemicals, detergents, solvents or degreaser approved by EPA and ADEC will be allowed.

Comment

85. "Cessation of the precipitation event" should be defined.

Response

"Cessation of the precipitation event" is now defined in the following permits:

Ladd Port Site (AK-004685-0), Part I.A.2.c.
Granite Port Site (AK-004331-1), Part I.A.2.b. (3)
Mine Site (AK-004357-5), Part I.A.2.c.

Cessation of the precipitation event for the NPDES permits is when the discharge decreases to the volume (flow rate) of discharge that preceded the precipitation event. The permittee has the burden to prove when the discharge (or increase in discharge) resulted from a precipitation event.

Both of these conditions have been added to the permits.

Comment

86. The NPDES permits should include references to the application of mixing zones to establish effluent limitations based on Alaska Water Quality Standards.

Response

The state water quality standards do not have any specific numerical standards for total suspended solids (TSS) or settleable solids (SS). Discharge of solids are controlled through turbidity and the "zones of deposit" (18 AAC 70.033) standards. Therefore, water quality based effluent limitations cannot be established for TSS or SS. The permittee has requested and received approval from ADEC for a mixing zone to meet the state's turbidity water quality standard. The mine permit (AK-004357-5, Part I.B.6 included in Appendix D) now includes a reference to the applicable mixing zone.

The permittee has not requested a mixing zone for iron or pH. Therefore, the more stringent water quality based limitations for iron and pH have been included in the permit. The limitations are based on the Alaska Water Quality Standards. 1.0 mg/l for iron and 6.5 to 8.5 for pH.

Comment

87. Daily monitoring of settling pond effluent is expensive and logistically difficult; recommend weekly monitoring.

Response

Flow monitoring has been reduced to weekly for the following permits:

Mine Site (AK-004357-5), outfalls 001-018
Granite Port Site (AK-004331-1), outfall 002
Ladd Port Site)AK-004685-0), outfall 001

Comment

88. ADEC must make sure domestic discharges will meet state standards before 401 certificate can be issued.

Response

ADEC has conceptually approved the wastewater treatment system plans. Final approval by ADEC of the detailed construction plan is required prior to construction.

Comment

89. Plans for sediment ponds outside the ASMCRA area have not been submitted to ADEC.

Response

DACC has submitted plans on location of sediment ponds in areas outside the mining permit area to ADEC.

Comment

90. AK-004357-5: Sampling of TSS, oil and grease should be maintained as proposed in draft permits.

Response

The previous (preliminary) draft permit required daily monitoring for TSS, oil and grease, and iron. These sampling requirements have been added but at a weekly sampling frequency and at least once during the period when the alternate effluent limitations apply. The oil and grease limitations and monitoring requirements have been deleted. Total hydrocarbon limitations and monitoring requirements have been added. See response to comment 81 above.

Comment

91. AK-004356-7: If the housing area is designed properly, there should be no need for sediment ponds.

Response

The sediment ponds built at the housing site will collect and treat runoff during and after construction activities. There will still be a need for sediment ponds after construction even if the housing area is designed properly. Runoff is expected to occur. The permittee should however, through Best Management Practices, control, reduce and/or eliminate the amount of pollutants carried in the runoff.

Comment

92. Comparing housing sediment ponds with ore or placer mining ponds is not appropriate.

Response

In establishing technology-based limits where no effluent guidelines exist, as is the case for establishing effluent limits for runoff from the housing site, performance of various treatment systems and characteristics of the wastewater to be treated were evaluated. In this situation, runoff from the disturbed areas near the housing site is similar to runoff from an active mining site. Effluent guidelines for an active mining site established a monthly average TSS limits at 20 mg/l (30 mg/l for a daily maximum). This is based on the treatment capabilities for the sediment pond receiving runoff from an active mining site. Based upon this evaluation, the effluent limits set for the housing site runoff were equal to the TSS limits from an active mining site.

- **Kevin Fenner** (Anchorage DEIS public hearing 8/17/88) Kenai Peninsula Borough

Comment

1. Document fails to point out that KPB is the local government entity responsible for local permits, services, etc.

Response

See revised Section 6.3 of the FEIS.

Comment

2. DEIS should incorporate KPB's Chuitna area resource development plan.

Response

Plan has been reviewed and incorporated into the FEIS where appropriate.

- **Larry Dinneen** (Anchorage DEIS public hearing 8/17/88) Port Commission of Anchorage (M.O.A.)

Comment

1. Municipality of Anchorage supports the project and port facilities on the west side of Cook Inlet.

Response

Noted.

- **Noel W. Kirshenbaum** Beluga Coal Company

Comment

Page 3-9/12

1. Tyonek pier at North Foreland location can handle 40,000 DWT vessels; a proposed 1000 ft. extension would allow it to handle PANAMAX class vessels. Beluga Coal Company has done studies between 1986-1988 on aspects of the dock. Shipping both Beluga Co. and Diamond Co. coal would not be possible with the currently anticipated design capacity.

Response

Noted.

- **John Evans** Tyonek Native Corporation

Comment

1. Were all three proposed port locations evaluated?

Response

All three port locations were evaluated fully; the evaluations process is described in Chapter 3.0. The North Forelands site was eliminated during the initial options evaluation due to technical feasibility problems (see Section 3.2.2.1). The remaining port options (Granite Point and Ladd) were subjected to complete evaluations based on all scoping issues (Chapters 2.0 and 5.0). Baseline information collected at both sites aided this evaluation (Chapter 4.0).

Comment

2. TNC has tried to interest Diamond in using the North Foreland Site. It would be less environmentally damaging than developing a new site.

Response

Conformation of offshore area and currents at North Forelands and currents are not conducive to development of a coal port large enough for the Diamond Chuitna Project.

Comment

3. Modifications could be made to North Forelands site.

Response

See previous response for Evans, comment #2 above.

- **Don Standifer** (Tyonek DEIS public hearing 8/18/88) Tyonek Native Corporation

Comment

1. Tyonek dock is underrated in comparison to the other dock sites, especially regarding tides and icing conditions.

Response

Refer to response to Evans, #2, above.

Comment

2. Concerned about the economic impact on Tyonek village of locating a dock north or south of existing dock.

Response

The broader issues of impacts of the project on Tyonek were discussed in Chapter 4.0 and Section 5.3.6.2. Specific impacts of locating the port at Ladd or Granite Point were not addressed.

Comment

3. TNC has acquired another airstrip that could be used by project.

Response

The planned airstrip has been designed to meet the needs of the project. If other airstrips are available which meet the project needs at time of construction, they will be considered.

- **Michael Meehan** (Anchorage DEIS public hearing 8/07/88) Archdiocese of Anchorage

Comment

1. Archdiocese property is strategically located to Ladd facility.

Response

Noted.

Comment

2. Archdiocese is interested in well planned development in Chuitna area.

Response

Noted.

- **Patti J. Saunders and Cliff Eames** Trustees for Alaska/Alaska Center for the Environment

Comment

Page 3-1

1. Mine site is not "fixed" but can be adjusted within the coal leases held by Diamond to avoid environmental problems such as the Lone Ridge moose rutting area and Chuitna watershed.

Response

The coal underlying the Diamond leases extends through the Beluga area, continuing under Cook Inlet and the Kenai Peninsula on the east side of the Cook Inlet. However, of these large deposits of coal, only certain relatively small areas are potential mine sites due to geological, engineering, or technical considerations. For example, the deposits underlying the Kenai Peninsula will likely never be mined since they are very deep. Some of the coal underlying the Diamond leases will not be mined for the same reason.

The Diamond Chuitna mine site shown in Figure 2-2 was selected after more than 500 core holes were drilled throughout and beyond the lease area to determine the location and thickness of coal seams. While the lease area was selected as having the best mining conditions in the Beluga area, there are large areas within the leases which will not be mined because of lack of coal or coal which is too deep. Because of the greater thickness and shallower depth of coal seams in the proposed mine site, this site will create the smallest total environmental disturbance; that is, the mine will ave the smallest surface area and the shallowest depth. Other sites would involve larger surface areas, greater depths, larger overburden stockpiles, more manpower, more and larger equipment etc., in short, larger mines.

In order to determine if mining will have an impact on moose rutting activities, the ASMCRA mining permit Stipulation 10 requires a 3 year aerial moose telemetry program focusing ont he Lone Ridge rutting area. The results of the survey will be reported to DNR and ADF&G by May 31 of each of the three years. At the third year, a revised plan of study will be submitted for the remainder of the permit term. In addition, starting with year 7, ground surveys of moose usage of revegetated areas will begin. From the data gathered, "...mitigation may be required as necessary to avoid or minimize any impacts to moose as identified by the monitoring program," (ASMCRA permit, Stipulation 10).

The potential effects of mining on the Chuitna watershed are extensively addressed throughout the FEIS as well as being a major topic in the ASMCRA permit and administrative hearing. Programs to address these potential impacts include an extensive system of sedimentation ponds, some with flocculation, and a program to pump pit water back into streams via the sediment ponds. Stipulation 6 of the ASMCRA Permit requires a water contingency plan. A comprehensive hydrologic monitoring system is required throughout the life of the mine including 55 wells for groundwater monitoring. A separate surface water quality monitoring system is also required. In addition, Stipulation 14 of the ASMCRA permit requires construction of at least one-half acre coho rearing ponds to mitigate for the unavoidable loss of some stream habitat in the mining area.

Comment

2. Timing of activities has not been considered.

Response

Timing of activities is based on numerous factors and has been reviewed by both EPA and the State of Alaska to assure minimization of negative aspects.

Comment

Page 2-20

3. Haul road is too wide; gravel sources would be wasted, reclamation more difficult.

Response

The northern/Ladd and eastern/Ladd haul road would be approximately 12.3 m (40 ft) wide to accomodate two 3.6 m (12 ft) traffic lanes, one 3.6 m (12 ft) breakdown lane, and road shoulders. Because of the offshore characteristics of the Ladd port site, the initial project, i.e., pre-conveyor system, can be relatively small. Smaller haul vehicles can be used on the access/haul road and barges can be used at the port site rather than ships.

If the Granite Point site is used, the project would not include a smaller start-up project. Full production build-up loads would be hauled on the road from the onset. This design utilizes extremely large "off the road" vehicles in the pre-conveyor production stages. These vehicles, up to 24 ft in width, require 9.2 m (30 ft) lanes. Therefore, two traffic lanes, one breakdown lane, and road shoulders would result in a road width of approximately 35 m (116 ft).

In addition, the other potential user(s) of the southern/Granite Point (Section 5.4.1.11) have also indicated a preference for the large "off the road" trucks requiring the 35 m (116 ft) road design. There has been no similar preference stated for the northern/Ladd road (Section 5.4.2.11).

Comment

Page 2-14

4. The conveyor and road corridor is too wide.

Response

The corridor is designed to accommodate both a conveyor and a road. When the haul road is no longer necessary, it may be turned over to the local jurisdiction for use while the conveyor is still being used.

Comment

5. Installation of a second road along the conveyor is unnecessary.

Response

The second road is a service road for the conveyor. Alignment is somewhat different from the haul road which does not follow the conveyor exactly. The haul road is designed to handle large trucks; the service road will accommodate light trucks only and can therefore be designed to different standards.

Comment

Page 2-19/Chapter 5.0

6. Fugitive dust emissions from the conveyor are inadequately addressed.

Response

The conveyor source dust emission factor was explained on page E-19 of the DEIS. This emission factor was previously reviewed by EPA and considered appropriate. This conveyor, due to being hooded and covered on one side, will effectively reduce fugitive dust emissions by 90 percent. This degree of control greatly reduces the emissions from this source.

The coal stockpile fugitive dust emissions were also generated using an accepted emission factor and a 50 percent control using water sprays. The conveyor and coal stock are two dissimilar sources of air emissions and would not be expected to have equivalent fugitive dust emissions. The exposed area of the conveyor only amounts to about 2.5 acres (2 feet wide by 55,800 feet long), while the coal stockpile at the port is about 25 acres. Also, the conveyor emissions are controlled by 90 percent, whereas the coal stockpile is controlled by 50 percent.

Comment

Chapter 5.0/Appendix E

7. Temporary overland truck coal haul fugitive dust emission calculations appear to be incorrect. (99 trips/day vs 331 trips/day)

Response

The correct figure is 311 trips per day. This has been corrected in the FEIS. This number of trips is associated with a hypothetical project option based on transporting coal to the port via truck during full production (12 million tons per year). This is only a transportation option and not the project as proposed by the applicant described and analyzed in Chapter 5.0, Environmental Consequences.

The 99 truck trips per day, associated with the proposed project, is the number of trips necessary to transport coal to the port during construction of the conveyor. Coal production would be about 4 million tons/yr.

The air quality impact assessment does not focus on construction emissions, but rather emissions during project operations. As stated on page 5-53, these temporary construction emissions must comply with the National Ambient Air Quality Standards but are exempt from the prevention of significant deterioration (PSD) increments.

The emission factor utilized to calculate fugitive dust coal haul emissions is an industry and agency-recognized and accepted factor. The state of Alaska Department of Environmental Conservation and the U.S. EPA recognize and utilize this emission factor. This emission factor, and the associated variables, were developed based on extensive field programs and actual measured data.

Comment

8. Exhaust emissions from temporary truck coal travel appear to be calculated incorrectly.

Response

The temporary truck coal haul exhaust emissions are calculated correctly. There is no utilization of truck fuel consumption in the air emission calculation. There is a utilization of truck horsepower and an EPA-recognized emission factor expressed in grams (of pollutant) per horsepower-hour (g/hp-hr).

The number of truck trips is correct as discussed in a previous comment.

Comment

9. Wind speed given in different units for different locations.

Response

Wind speed units have been standardized in the FEIS.

Comment

10. Wind speeds used for calculations appear low. Conveyor emissions appear low.

Response

Emissions for this project were calculated on an annual average and hourly basis. The annual average emissions utilized the annual average wind speed data. The hourly emissions were calculated by taking the annual average emission rate and accounting for the number of hours of operation per year.

The conveyor will be hooded and covered on one side to minimize fugitive dust emissions. Also, loose dust will not remain on the bottom of the conveyor on the return portion of the conveyor trip; thus, there will be no emissions from this portion of the conveyor.

Comment

Appendix E

11. Tuxedni National Wildlife Refuge is not closest to site; Kenai National Wildlife Refuge is closest. State game refuges at Beluga Flats and at Tyonek are very close.

Response

This comment refers to the visibility analysis performed in Appendix E, page E-22. This visibility analysis is required by the EPA PSD air quality regulations and is pertinent only to designated Class I areas. The Kenai National Wildlife Refuge, the Beluga Flats Game Refuge and the Tyonek Game Refuge are not Class I areas and thus no visibility analysis is required for these areas.

Comment

Page 2-45/Fig. 2-4

12. DEIS states that drainage from shops, washdown areas, etc. will be routed to sediment ponds with treatment facilities. Fig. 2-4 shows sediment ponds closest to mine facilities area to be without treatment facilities.

Response

Figure 2-4 of the FEIS has been modified to enable readers to know that booms and/or skimmers will be installed in Ponds 17 and 18.

Sediment pond systems 17 and 18 are located adjacent to the mine facilities area as shown in Figure 2-4. All runoff from areas affected by the mine facility would be collected by diversion ditches and routed to the sediment pond systems prior to discharge. According to ASMCRA application, Table 38 (page K-124) in Revised Appendix K, Drainage and Sediment Control Design, pond systems 17 and 18 would meet the total suspended solids and turbidity standards during the 2-year, 24-hour and 10-year, 24-hour storm events without flocculants and without receiving water dilution. Additionally, Volume XVII, pages 4-39 and 4-40 indicate that these sediment pond systems would contain booms and/or skimmers, if necessary, to prevent any discharge of oil, fuel, and grease into undisturbed areas. All pond system discharges would be periodically monitored and will comply with the oil and grease limitations established by the approved NPDES permit. All oil, fuel, and grease storage facilities would be constructed to prevent possible leaks and spills. Spill prevention and appropriate clean-up measures will be addressed in a Spill Prevention, Control, and Countermeasure Plan to be kept on file at the Diamond Chuitna Mine.

Comment

13. What kind of dust suppression chemicals will be used? How much? How often? What will effects be on fish, wildlife, ground water, streams, etc.?

Response

Potential dust problems are minimized by the greater than 40 inches of precipitation in the area. When rainfall is insufficient, water will be used. Once or twice a year, a chemical dust suppressant may be needed. Magnesium chloride or calcium chloride would be used for this purpose. Effects on aquatic and terrestrial resources are expected to be negligible.

Comment

14. Forested buffers should be maintained around stockpiles.

Response

Clearing of timber will be done only when required for mining or construction. Existing timber around coal stockpile areas will be left standing to the extent allowed by construction of roads and other facilities.

Comment

15. How are stockpiles to be protected against fires?

Response

Stockpiles will be protected against fire by "good housekeeping" procedures. Extensive experience in managing stockpiles in Alaska is available from the Sunnel Alaska Co. facility at Seward. In general, the conical piles resulting from conveyors and stacker reclaimers must be truncated and the coal compacted. Any hot spots which develop must be dug out so that they can cool before being compacted again.

Comment

16. Why is sewage sludge being buried in mine pit rather than incinerated?

Response

Burying sewage sludge in the mine pit is environmentally acceptable, especially for the small amounts which will be generated. It is common to place stabilized sludge in approved landfills unless land area is a problem, such as on Alaska's North Slope. In these cases, sludge is often incinerated. Environmentally, the trade-off is using land area with the potential for surface and ground-water pollution versus potential air pollution. Since land area is sufficient at this site, burying the sewage sludge is economically preferable. ADEC has provided a solid waste disposal permit, #8623BA002 for a sanitary landfill for the burial of commercial waste. This landfill will be located in the mine pit.

Comment

17. No discussion of effects of coal spillage from trestle and barges on marine environment.

Response

See revised Section 5.4.1.3 of the FEIS, "Impacts to Marine Environment".

Comment

18. DEIS fails to consider applicability of Clean Water Act's antidegradation requirement.

Response

See response to Trustees for Alaska/ACE comment #26, below.

Comment

Page 2-14

19. DEIS is inconsistent with draft Alaska permit regarding location of sewage outfalls.

Response

The DEIS is correct (Section 2.3.5) in stating that sewage is going to be treated at the mine site. The treatment plant appears in Figure 2-6 and in Map 4.01-2B Mine Facilities (Revised 5/87). Treated effluent from this plant will be piped to the housing area where it would join the treated effluent from the housing site and be discharged into the Chuitna River.

Two of the draft NPDES permits currently contain sanitary waste outfalls. Outfall 019 in permit AK 004357-5 for the mine is a sanitary waste discharge and outfall 001 in permit AK-004356-7 for the housing facilities is also a sanitary waste discharge. Since there is only one sanitary waste discharge (combined), EPA will amend these NPDES permits by deleting outfall 019.

Comment

Chapter 5.0

20. DEIS's conclusions about compliance with Alaska water quality standards are based on inaccurate assumptions.

Response

Tables 5-8, 5-9, and 5-25 (DEIS pages 5-31, 5-34, and 5-81, respectively) have been modified by correcting the pH range and noting that the standard for total dissolved solids is 500 mg/l or no greater than one-third higher than natural conditions, whichever is less. A note is also added explaining that information in these tables does not include dilution in a mixing zone. Therefore, information in these tables demonstrates neither compliance nor non-compliance with Alaska's water quality standards.

Comment

21. DEIS does not discuss excessive destruction of wetlands.

Response

EIS covers wetland impacts in Chapter 5.0. Wording added to sections 5.4.1.2, 5.4.2.1, 5.4.2.2, 5.5.1.3, 5.5.2.1, 5.5.2.3 to clarify wetland impacts associated with the alternative transportation corridors.

Comment

Appendix D

22. None of the draft NPDES permits include provisions for a Best Management Plan (BMP) as required by Clean Water Act.

Response

The proposed final NPDES permits now require the development of a BMP plan. The plan must be submitted to EPA for review and approval.

Comment

23. (1) Water quality-based limits are not included in the permit.

(2) Fecal coliform and chlorine limits for sanitary waste discharges are not included in the permits.

(3) Pollutants of concern listed in Tables 5-7 and 5-9 of the DEIS are not included in the permits.

(4) Also, the pollutants of concern should be included in the permits under technology-based consideration. Effluent limitations for toxic pollutants (such as metals) must be set using best professional judgement of BAT.

(5) In accordance with 18 AAC 70.020, the following parameters must be added to the permit: fecal coliform, dissolved oxygen, pH between 6.0 and 8.5, turbidity, temperature, total dissolved solids, sediment, toxic and other deleterious organic and inorganic substances, oil and grease (to all outfalls), radioactivity, total residual chlorine, and color.

(6) The 85% removal of BOD5 and TSS do not appear in conformance with the state standards.

Response

(1) See response to comment 86, Alaska DGC letter, above.

(2) See response to comment 86, Alaska DGC letter above.

(3) Comment referred to Figures 5-7 and 5-9. However, the correct reference is to Tables 5-8 and 5-9.

The EIS states (p. 5-33, DEIS) that the parameters that may equal or exceed water quality standards are boron, iron, nickel, manganese, ammonia (nitrogen) and zinc. However, no significant water quality impacts are anticipated. Monitoring for these parameters will be included in the permit. If monitoring results violate the water quality standards (after factoring in the applicable mixing zone) the permit will be modified to incorporate water quality-based limits.

(4) EPA has established national effluent guidelines that include limitations that represent BAT. In establishing these BAT effluent limitations EPA determined that the "effluent contained very low concentrations of toxic and nonconventional pollutants after application of settling." (EPA, Final Development Document for Coal Mining, EPA 440/1-82/057; p.6). The DEIS has shown that a few of the parameters have the potential to equal or exceed the water quality standards. EPA has determined that it is premature to establish water quality based limitations for these parameters. Instead, monitoring of these parameters will be required.

(5) EPA's NPDES regulations require that permits contain effluent limitations that are necessary to insure adequate treatment before discharge. Some of the parameters that the commentor has suggested for inclusion have not been identified as a pollutant of concern. These parameters will not be included in the permit as limitations or monitoring conditions. Those parameters that are of concern have been added to the permit to be monitored.

(6) The 85% removal requirement for BOD5 is a technology based requirement. The EIS concluded that the input from the sewage treatment plants will meet the state water quality standards. Additional water quality based limitations are not required.

Comment

24. Permits must be revised to include provisions for compliance with zones of deposit requirements of 18 AAC 70.033.

Response

18 AAC 70.033 allows ADEC, in its discretion, to "certify a permit that allows deposit of substances on the bottom of marine waters within limits set by the ADEC" (emphasis added). The only two discharges that are to marine waters are at the port site alternatives: Ladd Coal Loading Facility or the Granite Point Coal Port. Mixing of solids discharged from the sedimentation ponds will be rapidly dispersed in Cook Inlet. The allowable amount of solids discharged are anticipated to be essentially undetectable beyond the immediate area of the discharge point. Therefore, the establishment of a zone of deposition for either of these two permits is not necessary.

Comment

25. EPA must set maximum flow limits for sanitary waste discharges.

Response

Maximum flow limits have been included in the permits. See response to comment 82, Alaska DGC letter above.

Comment

26. EPA's failure to apply the antidegradation requirements of the Clean Water Act to this virtually pristine water system violates the Clean Water Act.

Response

The state's antidegradation standards are in 18 AAC 70.010. Water quality will be lowered due to the discharges from the entire operations. However, the degree of change will be minimal. All water quality standards will be met at the end of the pipe except for turbidity. The permittee has been requested a mixing zone for turbidity downstream of the sediment pond outfalls related to the mine. ADEC has approved the mixing zones for turbidity.

The discharge will not violate the state's water quality criteria or harm present or potential uses of the water. ADEC will be asked to certify that this is the case through the CWA 401 certification process. Only after the completion of the certification process can the NPDES permits be issued. It is through the certification process that the antidegradation requirements will be met.

Comment

27. It is not clear as to why outfall 019 is necessary if the DEIS is correct in stating that the mine site and housing site treated sewage will be mixed and discharge together.

Response

Outfall 019 has been deleted from the mine permit (AK-004357-5). See response to Trustees for Alaska/ACE comment #19 above.

Comment

Appendix C

28. Diamond's facilities are not well designed to minimize incursion on wetlands.

Response

DACC has taken into account the presence of wetlands which could be affected by the project. The proposed northern transportation corridor is aligned to avoid wetlands for two reasons: to minimize environmental impact and to minimize construction costs. The cost of building across open water or boggy areas is considerably higher than building on uplands. Therefore, the road alignment follows the highest terrain possible between the mine and the Ladd port site. Facilities within the Ladd port site are also sited to avoid wetlands for the same reasons. Drainage structures will be placed along all roads and other fills in order to avoid cutting off flow to wetland areas.

- **Reke Mishakoff** (Tyonek DEIS public hearing 8/18/88)

Comment

1. Concerned about the effects of the project on commercial fishing and subsistence.

Response

Effects on commercial fishing and subsistence have been discussed in Chapter 5.0 of the FEIS.

- **Tamara Smid** (Beluga resident)

Comment

Page 2-3, 2-14

1. Northern/Ladd transportation route crosses Threemile Creek (a fish stream) twice. Also crosses Lone Creek, another fish stream.

Response

These and other crossings are discussed throughout the FEIS.

Comment

2. Eastern/Ladd route crosses Lone Creek near Viapan Lake, through wetland used by birds.

Response

These and other crossings are discussed throughout the FEIS.

Comment

3. Southern/Granite Point route crosses Chuit and Old Tyonek Creek and wetland areas.

Response

These and other crossings are discussed throughout the FEIS.

Comment

Page 2-4, 2-6

4. If coal is present in entire Western Cook Inlet, should whole area be mined? What are other less environmentally damaging energy sources which could be used?

Response

At this time only Diamond Alaska has applied to mine coal in the area. Existing laws allow individual applications to be evaluated and approved or disapproved based on individual merits or impacts. Under NEPA regulations, cumulative impacts are addressed to the extent feasible.

Comment

5. Wetlands cannot be revegetated and remain as wetlands.

Response

Wetlands contain vegetation ranging from peat moss to black spruce. It is possible to revegetate disturbed wetlands with wetland plants or to create wetland conditions, and that is what is meant by revegetating wetlands. The ASMCRA application now contains a "Wetland Revegetation Plan" which has been accepted by the ADNR Division of Mining.

Comment

Page 2-14

6. Mine runoff would pollute lower elevations.

Response

The drainage and sediment control plan strategically locates ditches and sediment ponds to intercept all runoff from disturbed areas. This system will not allow "polluted runoff" to flow to "lower elevations" as the commentor states. Runoff water entering the ditch and pond system will be treated prior to discharge to area streams.

Comment

Page 2-9

7. Treatment of runoff will not clean the water.

Response

The commentor states that the receiving water temperature and density will change regardless of treatment. The temperature regimes of streams receiving discharges from sediment ponds are discussed in Volume XVII, pages 4-261 through 4-261h of the ASMCRA application. This discussion notes that although the temperature regimes of receiving streams could potentially be altered by solar heating or ambient cooling, no significant changes to natural stream temperatures would occur as a result of mine operation. Calculations were performed to determine temperature changes in receiving streams due to inflow of colder sediment pond water (winter) and warmer sediment pond water (late spring, summer, and early fall). Results of these calculations indicate a maximum change in downstream temperature of -0.31°C for winter months when average stream temperatures are above 0°C.

Calculations for the summer months are based on two situations. The first situation assumes that sediment pond water temperature would be the maximum value of ambient air temperature. This is not possible, but is a worst-case situation for predicting a maximum impact from warming. Under this situation, the maximum downstream temperature change is 0.25°C. The second situation assumes that sediment pond water temperature is the minimum value of ground water. This is also not possible, but a worst-case situation for predicting a maximum impact from cooling. Under this situation, the maximum downstream temperature change is -0.81°C. Since records indicate that diurnal temperature fluctuations average 4°C during the summer months, the predicted downstream temperature change of 0.25 to -0.81°C is much less than the average diurnal change of 4°C for natural stream temperatures during the summer months. These small temperature changes in the winter and summer will not cause measurable changes in density.

The commentor notes that treatment will not "clean the water" because the sediment ponds would be dredged periodically. The ponds need to be dredged because they, in fact, "clean the water". The purpose of the sediment ponds is to provide a quiescent area which allows the sediment to settle out of the water. The sediment that settles from the water accumulates on the pond bottom. The volume of settled sediment will increase over time to the point where there will not be sufficient space in the pond to store the settled sediment. If this situation is allowed to occur, sediment will be carried through the pond and to the receiving streams. Therefore, it is necessary to periodically remove these sediments by dredging. According to ASMCRA application Revised Appendix K, Drainage and Sediment Control Design, page K-118, the sediment ponds have been designed to contain 1 or 3 years of sediment volume depending on active pit location and mining progress.

Comment

Page 2-22
8. Figure 2-12 shows Granite Point port facilities - need same kind of detail for other port options.

Response

The same type of facilities shown for Granite Point would be built at the Ladd port site. As Figure 2-12 was simply an artistic conception, it was not necessary to duplicate it for Ladd.

Comment

Page 2-31
9. The statement that all stockpiles would be within mining limits is incorrect; KPB lease options indicate coal to be stockpiled around Viapan Lake and Ladd port site.

Response

There appears to be some confusion between coal stockpiles and topsoil stockpiles. Section 2.8.1.2 (DEIS page 2-31) discusses only topsoil stockpiles, all of which would be located within the mining limit. Coal stockpiles would be located within the port areas; no coal or topsoil stockpiles would be located at Viapan Lake.

Comment

Page 2-35/36
10. Mining would occur in major fish streams despite DACC's statement that they will minimize construction and mining in streams.

Response

Mining plans were designed to minimize impacts on all wildlife; however, unavoidably some smaller streams would be disrupted. The State of Alaska and DACC have agreed on replacement of this habitat through the mitigation plan included in the ASMCRA permit.

Comment

Page 2-43
11. Ladd port option not thoroughly analyzed.

Response

The Ladd port option has been thoroughly analyzed by DACC including preliminary engineering, environmental aspects, and offshore port design. The FEIS analysis of the Ladd port alternative is commensurate with that of the Granite Point port alternative.

Comment

Page 2-45

12. Air quality in Anchorage and the atmosphere will be degraded by slash burning.

Response

The Diamond Chuitna Coal Project would be almost 45 miles west of the Anchorage area. The magnitude of slash burning emissions and the distance from Anchorage make it very unlikely that Anchorage would be affected by air emissions from these activities. Slash burning emissions are temporary in nature and the predominant winds in the project area are from north and south, thus, not in the direction of Anchorage. The applicant must obtain permits from ADEC before burning slash.

Comment

Page 2-47

13. Environmental coordinator should be on site, not in Anchorage.

Response

During operations, the environmental coordinator will spend time both on site and in Anchorage.

Comment

Page 3-6

14. No discussion of predicted impacts of each coal transportation option.

Response

Detailed discussions of the impacts of all potential options listed in the DEIS were not undertaken because several were eliminated early in the impact analysis (Chapter 3.0) due to technical, economic, or environmental considerations.

Comment

15. Coal slurry is most environmentally sound option and it is dismissed.

Response

The coal slurry option was not chosen due to technological and economic considerations. It would have a similar environmental impact to the covered conveyor system.

Comment

Page 3-10
16. The environmental hazards of "Option 6" are not shown on Table 3-2.

Responses

Commentor's reference to "option 6" is unclear. This table shows major reasons why certain options were eliminated early in the evaluation process. Any options which were retained were evaluated in more detail in the EIS.

Comment

17. North Foreland option shown as eliminated.

Response

See response to Smid comment #16 above.

Comment

18. Blasting in August and September 1988 shows northern route is now the only option which remains.

Response

DACC is unaware of any blasting studies by Northern Geophysical.

Comment

Page 3-18
19. DACC has stated that a road would be used to transport coal for sometime despite Table 3-6 showing a high adverse impact from roads.

Response

The road will be used for coal hauling only until construction of the coal conveyor system is complete. Tonnages to be transported during this period will be low. See also response to DCG comment #19.

Comment

Page 3-29

20. This table shows Eastern/Ladd corridor as being environmentally better, but blasting by Northern Geophysical has shown that the Northern/Ladd route is better.

Response

See response to Smid comment #18 above.

Comment

Page 3-35

21. Paragraph 2, last sentence is a value judgement not based on fact, i.e., Northern/Ladd vs Southern/Granite Point comparison.

Response

The judgement was necessarily based on best professional knowledge following the logic of that section.

Comment

Page 4-38

22. Paragraph 4, first sentence: Fish which spawn in area streams are caught in other areas.

Response

The sentence refers only to resident fish, not anadromous fish such as salmon. Also, the sentence says that resident species are not significantly exploited in area streams, i.e., they are not fished heavily.

Comment

Page 4-38/41

23. Fish data from ADF&G in 1983 and 1984 were not typical of the area.

Response

Data referenced are not from ADF&G. Catches of various species in these two years in the upper inlet fishery, however, suggest that the 1983-84 period is fairly representative of the long-term trends (see the mean figures for 1966 through 1984 on Table 4-15 of the FEIS) i.e.,

Chinook: 1983 = 1.7 x average, 1984 = .75 x average

Coho: 1983 = 1.8 x average, 1984 = 1.6 x average

Chum: 1983 = 1.6 x average, 1984 = .97 x average

Pinks (even) 1984 = .50 x average

Pinks (odd) 1983 = .40 x average

Comment

Page 4-61

24. Air quality studies cited were done in areas already polluted and not in the mining and transportation areas.

Response

The EIS uses existing, representative air quality data to assess existing condition. See Section 5.3.4 for a detailed analysis of air quality impacts of the proposed project.

Comment

Page 4-77

25. Area residents were not surveyed to determine their attitudes toward the project. Tyonek residents are most concerned about destruction of fish and wildlife. Beluga residents and land owners were not mentioned in EIS.

Response

Although a formal "survey" of Tyonek was not done, interviews were conducted with 32 Tyonek residents. The results were summarized and included in Section 4.7 of the DEIS and FEIS. Concern of Tyonek residents regarding fish and wildlife were included in the report and the EIS. The data collection and analysis process reflects an "ethnographic key informant" approach, a standard socioeconomic study technique. Surveys are designed to quantify responses to project issues rather than to identify new issues. Beluga residents were not specifically included because the field work was done prior to the identification of the Ladd port site as an alternative.

Comment

Page 5-11

26. Value judgments were made regarding importance of lost wildlife habitat.

Response

NEPA guidelines require the use of best professional judgment when quantitative data is not available to the EIS preparer.

Comment

Page 5-12

27. Paragraph 5, last sentence: this may be construed as defense of killing moose and bear for sport and meat.

Response

State law allows killing of wildlife in defense of life and property. However, an animal which is killed must immediately be reported to ADF&G. Moose meat must be immediately turned over to the state. The same is true for a bear skin and skull. A report must be prepared immediately. The laws are designed to discourage unlawful harvest.

Comment

Page 5-45

28. If stream and ground water is polluted, the marine environment will be affected. Also, marine environment will be affected by the water and air cycles.

Response

It is recognized that minor changes in surface and groundwater quality will occur in the project area resulting from construction and operation. These changes may increase dissolved and suspended solids concentrations in the Chuitna River causing a slight increase of these materials entering Cook Inlet. Water affected by the project is an extremely small proportion of the total entering Cook Inlet in this area and, consequently, changes in marine water quality due to the project will be undetectable. Furthermore, Cook Inlet is a dynamic, glacial estuary having a tremendous natural sediment load, a huge volume of water, and strong tidal currents which assure that a change in marine water quality will not occur.

Comment

Page 5-45

29. Has the state petitioned to change their air emissions standards to allow permitting of this project?

Response

The Alaska Department of Environmental Conservation (ADEC) has adopted, and submitted to EPA, a revision to its permitting regulations to make them consistent with the minimum EPA requirements. The effect of this revision would be to exclude fugitive emissions from the determination of permit requirements for certain source categories. Under these revised rules, the Diamond Chuitna Coal Project would still be required to obtain a "permit to construct and operate" from ADEC, and must still comply with ADEC's requirements for the "prevention of significant deterioration" (PSD) because emissions from sources other than the mine exceed the PSD applicability level. The Diamond Chuitna Coal Project could obtain an exemption from the PSD requirements by reducing particulate emissions from sources other than the mine. Regardless of the ADEC permitting requirements, the air quality impact analysis done for the draft environmental impact statement demonstrates that the Diamond Chuitna Coal Project will comply with ambient air quality standards and PSD increments.

- **Myra Starkloff** (Tyonek DEIS public hearing 8/18/88)

Comment

1. DEIS needs to be redone because it takes too lightly the concerns of the residents.

Response

Public comment has been solicited throughout the EIS process. Refer to chapter 7.0 (Consultation and Coordination).

10.3 Public Comment Letters

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW
1689 C STREET, ROOM 119
ANCHORAGE, ALASKA 99501-5126

SEP 06 1988
OFFICE OF
REGIONAL ADMINISTRATOR

ER 88/637

RECEIVED
SEP 8 1988
EEB EPA/
REGION 10

September 1, 1988

Mr. Robie G. Russell, Regional Administrator
Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Russell:

We have reviewed the Draft Environmental Impact Statement (EIS) for the Diamond Chuitna Coal Project, and offer the following comments for your consideration.

We believe the EIS should include specific ground-water monitoring plans, which would include recording possible water-level changes and water-quality changes in the various aquifers involved. 1

Known faults that affect ground-water flow should be shown on appropriate maps and sections. Faults that are barriers to ground-water may affect flow direction or water levels, possibly increasing drawdown. These faults should be considered in evaluating aquifer characteristics and possible water-level changes. Additionally, water-quality effects should be assessed relative to the removal of impermeable faults that currently separate water of poor quality from better quality ground-water. 2

In general, we believe the document adequately describes the fish and wildlife resources in the project area, particularly with respect to the Granite Point alternative. However, we also believe the document needs additional information and analysis in its description and assessment of impacts that would occur with development of either the northern or eastern access routes associated with the Ladd port site alternative. We are also concerned with the lack of a comprehensive mitigation plan for each alternative described. 3

Earlier planning efforts and environmental studies placed heavy emphasis on Granite Point as the preferred alternative for port development. Valuable resource data were obtained with respect to development of this route; however, much of this information may not be transferable to the two alternate Ladd port site routes, neither of which has been adequately studied or evaluated with respect to fish and wildlife impacts. Therefore, it is difficult to determine on what basis the eastern Ladd route has supplanted the Granite Point route as the route with the least environmental effects. Also, this lack of information hinders our ability to formulate specific mitigation recommendations. We feel that appropriate studies must be conducted on the two alternative Ladd routes to equitably compare these options. We strongly urge that habitat-based assessment techniques be utilized to quantify both adverse and beneficial impacts. This could entail use of the Fish and Wildlife Service's Habitat Evaluation Procedures or a comparable methodology. 4

Once this information has been generated, a comprehensive, detailed mitigation plan should be developed for each alternative. This plan should include specific mitigation measures, implementation schedules, and appropriate funding mechanisms for all identified adverse impacts. In this regard, we recommend the consideration of an interagency team to oversee all mitigation and monitoring activities (terrestrial and aquatic), assess mitigation and monitoring results, and identify any additional mitigation that may be justified by those results. Funding for these efforts should be included as part of project costs. 4

The mitigation approach and planning documentation by the Alaska Power Authority for the Susitna and Bradley Lake hydroelectric projects may provide helpful technical assistance to planners as they proceed with a formal mitigation plan for the Diamond Chuitna Coal Project.

In summary, we believe the EIS needs additional information concerning ground-water in the project area and the effects associated with the Ladd site access routes, and mitigation needs and measures. It is also important that sufficient data be available for the determination of mitigation needs for the timely processing of future project related permit applications.

We appreciate the opportunity to comment on this draft.

Sincerely,

Paul D. Gates
Paul D. Gates
Regional Environmental Officer

cc: Rick Seaborne, EPA

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX [illegible]
ANCHORAGE, ALASKA [illegible]

REPLY TO ATTENTION OF:
Regulatory Branch
Special Actions Section

SEP 13 1988

RECEIVED
SEP 16 1988
EEB EPA
REGION 10

Rick Seaborne
Environmental Protection Agency, WD-136
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Seaborne:

This letter provides comments in regard to the Draft Environmental Impact Statement (EIS) on the Diamond Alaska Coal Project. The Corps of Engineers (Corps) reference numbers for this project are 2-850259 (Cook Inlet 330), 2-850260 (Cook Inlet 331), and 2-850261 (Cook Inlet 332).

The Corps appreciates the opportunity to comment on this document and to be designated a cooperating agency for this EIS. The major concerns which still need to be resolved include mitigation concerns and the relationship of the surface mining permit and its stipulations to the EIS process. In addition, the draft 404(b)(1) evaluation which was prepared by Dames and Moore was left out of Appendix C. 3

In regard to mitigation, the treatment of various mitigative options in the DEIS are not sufficiently identified and developed in order for a comprehensive mitigation package to be put together. In order for the Corps to use this EIS process for our review and decision making, the DEIS should be detailed enough to provide a comprehensive evaluation and recommendation of mitigative features which would allow the project to be consistent with the 404(b)(1) guidelines and the public interest review. Many mitigative features have already been incorporated into the project by the applicant and as a result of the NEPA process to date. These items should more clearly be listed in order for the reviewer to determine the extent of mitigation which has already been made part of the project. (These are primarily reducing, avoiding and minimizing measures.) 1

Also related to the mitigation concerns and impact assessment is the Division of Mining Surface Mining Permit which has already been issued. This permit has many mitigative requirements for the mine pit which have already been agreed to by the applicant and which are not specified in the DEIS. A detailed review of those requirements in the EIS would help reviewers and the applicant by ensuring that duplicating or conflicting stipulations are not put on permits. A preliminary review of the Surface Mine permit stipulations indicates that there may already be sufficient mitigative and monitoring efforts built into the Surface Mine permit to satisfy many of the resource agency concerns for the mine area. If this is the case, it would greatly simplify the subsequent review for the remainder of the project features.

The development of the Ladd corridor alternative is not commensurate with the development of other alternative measures and not sufficient for a detailed review. The applicant should more fully develop this alternative, particularly since it seems to be a preference of the applicant. 2

Should you require additional information on this subject, please contact Ms. Carol Gorbics of my staff at (907) 753-2724.

Sincerely,

Larry L. Reeder

Larry L. Reeder
Chief, Special Actions Section
Regulatory Branch

STATE OF ALASKA
OFFICE OF THE GOVERNOR
DIVISION OF GOVERNMENTAL COORDINATION

STEVE COWPER, GOVERNOR

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REGISTERED MAIL
RETURN RECEIPT
REQUESTED

September 22, 1988

RECEIVED
SEP 26 1988
EEB EPA/
REGION 10

U. S. Environmental Protection
Agency
Attn: Mr. Rick Seaborne
WD-136
Region 10
1200 Sixth Avenue
Seattle WA 98101

Dear Mr. Seaborne:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
DIAMOND CHUITNA COAL PROJECT
PHASE 2 - STATE I.D. NO. AK880705-02A

The Division of Governmental Coordination (DGC) has completed coordinating the state's review of the Draft Environmental Impact Statement (DEIS) on the Diamond Chuitna Coal Project. The DEIS was circulated by the U. S. Environmental Protection Agency (EPA) for review and comment pursuant to the National Environmental Policy Act (NEPA).

Diamond Alaska Coal Company (DACC) proposes to develop a twelve million ton per year coal mine in the Chuitna region of upper Cook Inlet, approximately 45 miles west of Anchorage. The project would consist of an open pit mine and associated coal transportation and port facilities, service facilities, and housing accommodations. The project requires National Pollutant Discharge Elimination System (NPDES) Permits from EPA for discharge of pollutants from the mine, port, coal loading, and housing facilities to navigable waters. Additionally, various project activities require permits from the U. S. Army Corps of Engineers (COE). Pursuant to NEPA, the Environmental Impact Statement (EIS) process was initiated in response to DACC's application for these permits.

The review of the draft and final EIS documents and the associated federal permits constitutes Phase 2 of the state's permitting process for the Diamond Chuitna Project. We are

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providing comments on the DEIS to be either addressed or included, as noted, in the Final Environmental Impact Statement (FEIS). The state will complete our Phase 2 review and our Coastal Management Program consistency finding between the issuance of the FEIS and preparation of the Record of Decision.

DGC received comments on the DEIS from the state Departments of Environmental Conservation (DEC), Fish and Game (DFG), Natural Resources (DNR), and Transportation and Public Facilities as well as from the State Historic Preservation office and the Kenai Peninsula Borough. Reviewers noted that in comparison to the Preliminary DEIS, the DEIS is much improved and the state acknowledges the considerable effort of the EPA and document preparers in producing this comprehensive planning document.

The state's comments on the DEIS are separated into general comments, page-specific comments, and comments on the NPDES and COE permits. For purposes of clarification of our comments and to provide specific information to EPA on the technical review previously completed by the state, we have included a discussion of our Phase 1 permitting for the project within the general comments.

GENERAL COMMENTS

EIS Process and State Phase 1 Permitting

Prior to issuance of the DEIS, the state completed initial permitting for the port, transportation, housing and mine components of the project. Through this Phase 1 permitting process the initial ten year project, affected resources, and associated impacts were reviewed and, for the mine component, detailed monitoring programs and specific mitigation measures developed. The state Surface Mining Permit application required pursuant to the Alaska Surface Coal Mining Control and Reclamation Act (ASMCRA) was the impetus for this detailed review and the development of the monitoring and mitigation for the mine permit area. Through ASMCRA, the state has primacy over permitting for coal mining in Alaska. The federal Office of Surface Mining Reclamation and Enforcement (OSMRE) oversees the state program. The state ASMCRA regulations for coal mine development must be at least as effective as the federal OSMRE regulations.

From January 1985 to June 1988 the state conducted completeness and technical adequacy reviews of the Phase 1 permit applications for the project. This included a 27 volume application for a Surface Mining Permit required under ASMCRA.

The states nearly 3 1/2-year process included the following steps:

- A 13 month Completeness Review, which generated 33 pages of agency comments; 11 separate reports to the state by 3 contractors totalling 237 pages; 56 pages of Findings by the DNR; and one major revision of the Permit Application by the applicant.

- A 13 month Technical Adequacy Review, which generated 144 pages of agency comments; 10 separate reports to the state by 5 contractors totalling 626 pages; 469 pages of public comments and transcribed testimony; 358 pages of Findings by the DNR; and two major revisions of the Permit Application by the applicant. This process culminated in a decision by the state on March 5, 1987 to require modifications to two major aspects of the permit application, plus an additional 23 permit stipulations.

- A 5-month review of a fourth major revision of the Permit Application submitted by the applicant in response to the state's initial (March 3, 1987) permit decision, which generated 36 pages of agency comments; 32 pages of public comments; an additional contractor report totalling 39 pages; and 47 pages of Findings by the DNR. This process culminated in a decision by the state on August 21, 1987, to approve the permit with 19 stipulations.

- A 10 month Administrative Hearing process which considered over 25 separate appeal issues raised by the applicant and by Trustees for Alaska. Over twenty full or partial days of oral testimony by 16 witnesses was heard. The hearing generated 1,339 pages of briefs, motions and other documents, and culminated in a decision upholding the state's permit approval and stipulations on all but two minor points. This decision was adopted by the state on June 28, 1988.

- A subsequent appeal of the state's permit decision was filed in Alaska Superior Court on July 28, 1988, and is currently in progress.

The Phase 1 review was completed by technical staff of the state resource agencies as well as private technical consultants under contract to the state. The revisions to the ASMCRA application and the development of project monitoring and mitigation stipulations were based on the technical review by these parties well as on discussions with and review by DACC and their ical consultants.

Because of this, the state strongly recommends the DEIS authors review the technical evaluation completed by the state during the Phase 1 permitting. We recommend that the FEIS reflect, as the preferred alternative for the mine component, the monitoring and mitigation developed as a result of this extensive process for the mine's initial 10 years as permitted by the state through ASMCRA. 1

The state has previously provided EPA with our ASMCRA Surface Mining Permit decision and our finding of consistency of the Phase 1 project with the ACMP. During the course of the DEIS review we have discussed with the COE and EPA the benefits of a detailed review of the ASMCRA application and our decision documents. State staff are available to assist the federal agencies as well as the DEIS preparers with this review.

The ASMCRA decision applies only to the geographic area covered by the Surface Mining Permit and the monitoring and mitigation apply only to the initial 10 year permit term. The state recognizes that the DEIS and FEIS have a much broader scope and term. We agree with the DEIS authors that special problems exist in predicting the extent, magnitude, and duration of potential impacts as mining progresses over a period of 30 years. However, because of the strenuous requirements of the ASMCRA regulations, the state believes that the decisions made pursuant to these regulations should be mirrored in the FEIS discussions of the mine area, project impacts, monitoring and mitigation for the initial 10 years. This comment is referenced repeatedly in our page-specific comments.

Where possible we have separated our comments on the remaining 20 years covered by the EIS from the initial 10 years. Because the detailed monitoring and mitigation have not been developed for project components outside the ASMCRA permit boundary, we also distinguish between the ASMCRA permit area and the other project areas (i.e., road, transportation, housing, conveyor and port).

Mixing Zone and State Water Quality Standards

Although the DEIS provides a discussion of application of the state receiving water standards, eg. the Alaska Water Quality Standards, too little information is provided concerning the applicability of a mixing zone. While both the EPA and state standards can or do apply at the point of discharge, the state standards may by applied to the receiving water when a mixing zone is designated. The state's ASMCRA review identified that discharges from the sediment ponds serving the active mine site are likely to require a mixing zone to comply with the state receiving water standards. If the discharge site meets specific criteria, the state can permit a mixing zone enabling a discharge 2 to achieve the receiving water standards at the boundary of the zone. Although the mixing zone concept is mentioned in the DEIS, neither the DEIS, nor the draft NPDES permit address the application of a mixing zone. 2

The DEIS identifies that under winter lowflow/baseflow conditions, compliance with the Alaska Water Quality Standards is not projected by recent studies and modelling. The state's ASMCRA review reached the same conclusion. Based on such uncertainties and to assure that state standards will be met, the state is requiring that the applicant develop a water quality contingency plan. The contingency plan provides for implementation of a variety of measures to ensure the active mine discharge achieves compliance with the Alaska Water Quality Standards. The contingency plan is required and described in stipulation 6 of the Surface Mining Permit and is also a condition of the Phase 1 project's consistency with the ACMP. This contingency plan must be reviewed and approved prior to issuance of the 401 Certification from the DEC for the EPA NPDES permits and the COE Section 404 permits.

Therefore, the operator's reliance on the mixing zone to meet state water quality standards along with the contingency plan stipulation should be described in the FEIS and the NPDES permit.

Development of Mitigation Measures

The state acknowledges that special problems exist in attempting to assess project impacts over the 30 year term covered by the DEIS. As the DEIS suggests, this will require a flexible approach that is responsive not only to the results of acquired monitoring data, but to potential advances in mitigative techniques. We support this approach to ensure that appropriate mitigation is consistently applied throughout the tenure of the project.

In reviewing the ASMCRA permit application for the mine, the state utilized an integrated process to define whether specific impacts can be avoided, minimized, rectified or reduced. If not, then mitigation for unavoidable impacts was required in concert with monitoring to quantify the effects of mitigative efforts while identifying additional impact trends.

As described above, the process for review and approval of the ASMCRA Surface Mining Permit was extensive. This process considered virtually all of the mitigation options proposed by EPA in the DEIS. Many of these were developed into detailed requirements, several other options were rejected (See page-specific comments for further detail). The process involved all the state resource agencies and the mitigation and monitoring plans developed received extensive public review and input.

The DEIS presents project mitigation in the form of various options that regulatory agencies may adopt during permitting. This approach does not take advantage of the mitigation information available as a result of the extensive state effort for the mine permit area for the 10 year permit term. Additionally, this approach renders the DEIS ambiguous regarding appropriate mitigation both within and outside of the mine permit area. Finally, because the DEIS fails to specify a preferred mitigation plan with justifying rationale, it does not illustrate what EPA supports and why. 3

The state has several recommendations to correct these deficiencies in the FEIS. First, as stated above, the state strongly recommends that the FEIS reflect the mitigation measures developed via the ASMCRA process for the mine permit area for the initial 10 year term. Secondly, the state recommends that, for the project components outside the mine area, the EPA evaluate whether impacts can be avoided, minimized, rectified or reduced prior to defining compensation as the initial mitigation approach. Finally, the state recommends that the appropriate mitigation beyond the initial 10 year term for the mine permit area and for the other project areas be identified prior to issuance of an FEIS via a federal/state/applicant workshop forum. 4 The appropriate feasible mitigation/monitoring identified would then be reflected in the FEIS. The suggested approach is to review the specific impacts associated with or anticipated from various project components and then if these impacts cannot be avoided, to assess the ways they may be minimized, rectified or reduced.

The preparers of the DEIS held such a workshop on the project fisheries mitigation plan in August 1985. We believe reconvening this forum would allow development of a greater degree of specificity in the FEIS and would greatly reduce the potential for conflicting or changing mitigation requirements, which would be unworkable for the applicant, from various permitting agencies. The suggested approach would also allow the FEIS to reflect the project specific expertise of state and federal resource agency staff many of whom have worked extensively on the DACC proposal over the past several years.

The interagency/applicant workshop approach has been implemented successfully on other large scale developments in Alaska. In some cases the working forum continues to meet bimonthly to review necessary proposed project modifications and/or monitoring results.

The DEIS references an aquatic habitat committee as a mechanism to assure implementation of mitigation measures. The interagency group suggested by the state is recommended as a "technical review" rather than "enforcement" forum and is not intended to "assure implementation" of mitigation measures. Although on other projects the interagency working forum has not been formally designated as a committee it has been effective in reviewing both terrestrial and aquatic project impacts, mitigation, and monitoring. We suggest the FEIS preparers contact the state for for assistance coordinating this forum. Further we suggest that the FEIS describe this interagency/applicant group rather than an aquatic habitat committee.

PAGE-SPECIFIC COMMENTS

Page S-2. The conveyor structure is described as being enclosed on top and one side except at stream crossings where the underside would also be enclosed. No discussion is provided regarding the loss of coal particulates along the conveyor in areas other than stream crossings. The state recommends that the entire conveyor be covered on the underside in conformance with the applicant's original design unless EPA identifies where and when this design is not appropriate. If EPA identifies portions of the conveyor for which this design is not appropriate the FEIS should address how, in these portions, accumulation of coal fines and runoff below the conveyor would be addressed. 5

Page 2-9. It is stated that all of the sediment pond discharges from the mine area will meet applicable standards. However, concerning documentation submitted in conjunction with the state Surface Mine Permit, it is apparent that the applicant can't meet the Alaska Water Quality Standards without the use of a mixing zone. As stated in our general comments, the FEIS should address in some detail the necessity of a mixing zone. 6

Page 2-14 and Figure 2-4. It is noted that runoff from the mine facilities area is to be processed by two sediment ponds for settling and treatment prior to discharge to stream 2003. However, according to Figure 2-4, the ponds discharging to stream 2003 do not include treatment works. According to the ASMCRA Permit application approved by the state, all of the sediment ponds are designed to accommodate treatment works (in most cases a two stage flocculation system). The legend to Figure 2-4 should be revised such that it does not identify some ponds as not having treatment works. Instead, the legend could differentiate between those 13 pond systems where the state has required that at least a single stage flocculation system be fully functional prior to the ponds being operated as opposed to the remaining 5 pond systems where installation of flocculation equipment will depend on results actually achieved in the field. See Stipulation 1 of the state's August 21, 1987, Decision. 7

Page 2-15, Southern Corridor Conveyor. The map of this corridor shows buried moose crossings in the vicinity of the Chuitna River that are designed to occur on the immediate bluff area overlooking the river. However, these same crossings are noticeably absent from the artist's illustration on page 2-18. The bluff area above the Chuitna River is a critical migration route, and it is essential that the conveyor provide moose passage in this area. Therefore, the FEIS should clarify that the conveyor will, in fact, be buried in this location. 8

Page 2-16, Figure 2-8. Potential gravel sources need to be depicted more clearly, and an explanation provided as to why the general areas identified are believed to represent the best locations. 9

Page 2-19. Apparently the conveyor belt is to be "partially enclosed on the underside" where the belt crosses a stream. The "Partially enclosed" needs further clarification, as the diagrams provided are not adequately detailed. 10

Page 2-19, paragraph 3. The process that led to the development of wildlife crossings on the southern corridor route was site specific, and based on known moose movements in that area. The document should not assume that distance or design criteria established for that route apply to either of the other two route alternatives. 11

Pages 2-25 and 2-44. Although the SPCC Plan for oil spill contingency and planning is discussed, no mention is made of siting controls for the oil and fuel storage area. With a four month supply on hand, it is likely that the operator will need a lined area with a contained berm to control potential spills. The FEIS should reference this requirement and note that the contained area is required to hold 100% of the capacity of the largest tank, while maintaining 12 inches of freeboard. 12

Page 2-27. The method of sludge disposal will be hauling it to the mine pit for burial. The FEIS should note that this proposal will require coordination with the state DEC to assure compliance with the Solid Waste Regulations, 18 AAC 60, eg. stabilization of the sludge prior to disposal. 13

Page 2-30. The statement that "Any soil which does not meet the applicant's standards for revegetation also would be covered with a minimum of 1.2 m (4 ft.) of nontoxic and noncombustible spoil material," is no longer correct. The applicant removed this commitment from the final revision of the ASMCRA permit application, approved by the state. 14

Page 2-34, Fish Mitigation Plan. It is unclear why the applicant's fish mitigation plan is described in this section, and the wildlife mitigation plan is not. 15

Pages 2-39 and 2-41, Concerning Mine Site Preparation. The clearing and windrowing of trees and brush for burning is described, including provisions for burial in the mine pit if burning is not possible. However, as the mine pit would not be available for two to three years, in order to prevent beetle infestation, the operator would need to cut the trees into logs and peel and stack them. The same conditions would apply to the conveyor corridor. 16

Page 2-41, Conveyor Construction. The DEIS identifies that all the vegetation in the conveyor right-of-way corridor will be cleared. To reduce the potential for erosion and to maintain important wildlife habitat, the FEIS should include mitigation that will minimize impacts from vegetative clearing. These measures should be included in Chapter 6.0 and could include measures such as selective clearing. 17

Page 2-46, paragraph 4. It should be specified what types of chemical dust suppressants are likely to be applied and if any environmental considerations are associated with these chemicals. Water, rather than chemical dust suppressants, is presently being used at the one operating coal mine in Alaska. 18

Page 3-6, Road. The DEIS estimates that during full production approximately 23 double trailer coal trucks will make approximately 311 round trips per day between the mine and the port site. This scenario, if realized, will result in major impacts to wildlife that live in the vicinity of, or cross, the haul road corridor. Additionally, air quality modelling shows that at full production, if trucks are used to haul the coal, the increment for fugitive dust designated in the Prevention of Significant Deterioration of Air Quality (PSD) program would be exceeded. 19

For these two reasons the FEIS should recommend against long term use of the haul road if full production is achieved.

Page 3-13, Transportation Corridor/Port Location. A significant weakness of the alternatives selection process is that adverse impacts are weighted on the basis of the amount of acreage that will be affected by each of the various alternatives. We believe this is a biologically simplistic approach when assessing impacts to moose movement and use of adjacent habitat. For the conveyor and roads, the direction of the route in relation to other factors such as topography, migrational paths, or adjacent critical habitat areas 20

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may be more important than the amount of surface area lost. All else being equal, routes that parallel and/or cross few drainages are preferable to other routes. Moose movements that occur quickly (i.e., from pre-winter alpine areas to lower level early-winter range in response to severe snowfall) tend to be along drainages. Therefore, the fewer drainages that are affected by developments, the less likelihood there is that moose will have difficulty negotiating these changes. 20

Page 3-16, paragraph 1. No evidence is presented to support the opinion that the "Effects upon animal movements . . . would be similarly moderate." This statement may be true, but an analysis of moose movement data and the design of established wildlife crossings should be used as the basis for evaluating potential impacts. 21

Page 3-19, paragraph 6, last sentence. We are unaware of any commitment on the applicant's part to establish large animal crossings on the conveyor route to Ladd that conform to the migratory movements of moose. The subject sentence only remains true if the large animal crossings are placed according to migratory movements of moose. The document should reference this as a requirement of effective impact reduction via animal crossings. This item should also be included in Chapter 6.0 under mitigation. 22

Pages 3-33 through 3-35, Identification of Preferred Alternative. The FEIS should explain in greater detail what selection of a preferred, and secondary preferred, alternative means. The DEIS identifies the Eastern Ladd alternative as the preferred alternative. It is our understanding that, because the applicant and the Tyonek Native Corporation have apparently been unable to negotiate a right-of-way agreement for a transportation corridor to Ladd, the DEIS is compelled to develop a secondary preferred alternative that is less environmentally sound (i.e. Granite Point). Therefore, it seems appropriate that some additional discussion be given to explaining why this action is consistent with provisions of NEPA. It is our understanding that DACC prefers the Northern Ladd alternative. We request that the FEIS explain what obligations are conferred upon an applicant to modify a plan of operations if the NEPA preferred alternative and Record of Decision differ from the applicant's proposal. 23

Page 4-1, paragraph 3. The Moquawkie Indian Reservation was established in 1915, not 1934. 24

Page 4-17, paragraph 2. The statement that "moose concentrate in small groups at higher elevations" should be expanded. As written, it could mislead readers by implying 25 that the total number of moose in the Lone Ridge concentration is small. In addition, the document should include a more detailed discussion of the rut concentration itself, since it's characteristics and use by moose for breeding and pre-winter feeding have not been adequately addressed. Recent results of the state's Kenai Moose Research Center suggest that disruption of post-rut/early winter feeding may be as dangerous to moose populations as disruptions to successful breeding. Consequently, we suggest that the FEIS devote further attention to this possibility, and note the fact that very little information exists to predict the response of the Lone Ridge rut concentration to coal development. 25

Page 4-29, Flooding Characteristics. The FEIS should discuss how the flooding which occurred in October of 1986 compares to the maximum recorded flood on September 20, 1976. 26

Page 4-65, paragraph 3. The DEIS makes the statement that "substantial subsistence activities are conducted" in the Kenai Peninsula Borough. This is true for portions of the borough, such as Tyonek, English Bay and Port Graham, but generally not the case for the road-connected areas of the borough. Except for the three places named above, Seldovia, and the west side of Cook Inlet, the borough has been classified as being non-rural by the Joint Board of Fisheries and Game, meaning that subsistence uses are not a principal characteristic of the economy. 27

Page 4-89, paragraph 2. The document should clarify that the winter moose hunt was a subsistence and recreational hunt only from 1983 to 1985. It is now a subsistence only hunt. 28

Page 5-11, Wildlife. An additional adverse impact that should be considered is direct mortality from moose/vehicle collisions. The state is concerned that haul road mortalities may have a significant impact on moose and other wildlife. 29

Page 5-19, Groundwater Quality. In several places, degradation of ground water quality from leakage emanating from sewer lines and sewage treatment areas is identified. Assuming proper construction materials and techniques are utilized, leakage should not pose a threat to the environment. It is also stated that "somewhat poorer" water quality will result from the mining. The resulting water quality should be further described in this discussion, with appropriate references to Water Quality Impact Analyses presented in the ASMCRA permit application Vol. XVII, Section 4.12.12.7. 30

Page 5-19, Surface Water Hydrology. This section should mention the possibility that natural stream temperatures and icing conditions could be modified by mine development. The applicant predicted changes in downstream temperatures of -0.31°C (maximum) during the winter, and -0.81°C (maximum) during the summer. (See ASMCRA Permit Application Vol. XVII, pp. 4-261 through 4-261h). DNR's March 5, 1987 Findings concluded that these changes would have only a minimal effect on fish but also concluded that the magnitude of any temperature change could not be entirely predicted at this time. Therefore, a stipulation requiring continuous temperature monitoring was included in the decision (See Section II of the March Decision, p. 39-41). This monitoring program was subsequently incorporated into the permit application (Vol. XVII, p. 4-232). 31

Page 5-20, Surface Water Runoff. Surface water runoff from compacted gravel areas such as roads and staging areas is subject to state water quality standards. Treatment of runoff from these areas within the ASMCRA permit area has been addressed. For these areas outside the mine permit boundary, the document should discuss how runoff will be treated in order to meet state standards. 32

Pages 5-25 and 5-35. The discussion concerning water quality requirements, including state receiving water standards should be expanded. Although the EPA standards provide for waiving of certain EPA effluent criteria during storm events, the state water quality standards still apply, subject to accounting for variations in natural streamflow conditions. The problems occur when the post storm event, stream hydrograph and natural conditions have returned to normal, whereas continued pumping of the in-pit sumps would result in a continued elevated discharge. The document should note that the applicant has made a commitment not to pump out of the in-pit sumps unless both state and EPA water quality standards can be met and that the operator will have to work with the state in controlling the discharge to ensure compliance with state standards. 33

Page 5-28. As the most stringent standards apply, per the Alaska Water Quality Standards, the pH range specified should be 6.5-8.5 pH units. Because oil and grease have been identified to be present in the waste water, they should also be addressed in this section. 34

Page 5-30. The discussion indicates that discharge compliance with the Alaska Water Quality Standards during winter lowflow/baseflow conditions is not projected by recent studies and modelling. DACC does however project that compliance will be achieved after application of a mixing 35 zone. See Vol. XXI, Table 40 of the ASMCRA application. As stated previously, details of proposed mixing zones have not been provided, causing the technical justification which is the focus of this review, to be incomplete. Further discussion should be added to the FEIS.

There is considerable uncertainty relative to predicting effluent discharges from this project, particularly under winter conditions. The discussion in the DEIS speculates that due to a variety of circumstances, presumably in favor of the operator, the operator will be able to meet the Alaska Water Quality Standards. It would be more relevant for the FEIS to reference the requirements of Stipulation 3 of the state's August 21, 1987, Decision relating to treatment of winter baseflow. In addition, this section should address mixing zones as well as the Water Quality Contingency Plan required by the state. 35

Pages 5-31, 5-34, and 5-81. There is some discrepancy between this table and the applicable standards. Please note that the Alaska Water Quality Standards reference EPA's Quality Criteria for Water when specific limitations are not provided. In some cases these levels are lower than the Alaska Drinking Water Regulations. For example, the fresh water and marine water chronic criteria for arsenic are 48 and 5 ug/l respectively. The fresh water chronic criteria for copper is 12 ug/l. As the most stringent standards apply, the criteria in Tables 5-8, 5-9, and 5-25 need to be reassessed to reflect the applicable standards. Also, the levels of hydrocarbons, oil and grease, turbidity and sediment (settleable solids) are not reflected in these tables. 36

Page 5-32. The use of flocculants is indicated in several places in this document, yet the DEIS does not specify if, how and what flocculants will be applied. The state ASMCRA review addressed the requirements for flocculant stations in the sediment and drainage control plan for the Surface Mine Permit area. The FEIS should reflect the information in the Surface Mining Permit application and state decision. See Stipulation 1 of the August 21, 1987, Decision. Further, additional specifics on the requirement for use of flocculants outside the mine permit area should be provided. 37

Page 5-33. This discussion addresses elevated levels of suspended solids in the in-pit sumps/in-pit settling areas during high rainfall, storm run-off events. However, there is no recognition of problems with continuing to discharge post-storm event, turbid run-off from the in-pit sumps. The document should reference the applicant's commitment to only pump from the in-put sumps when the discharge can meet the 38

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state water quality standards. Additionally, this section should include reference to the Water Quality Contingency Plan and contingency measures to be developed to assure compliance with the standards. 38

Page 5-69, paragraph 1. The first paragraph identified five potential effects of the project on subsistence uses, but the DEIS discusses only two of them in the sections that directly follow. Furthermore, there is no reference in the document as to where these other potential effects might be located. We agree that all five are potential issues, and suggest that they all be discussed in one section, or at least referenced elsewhere. 39

Page 5-69, paragraph 4. This paragraph states that "moose abundance is not expected to decline drastically because of the project . . . ." The state has identified numerous project impacts that could contribute to a decline of unknown magnitude in moose abundance. Potential impacts include disturbance to the Lone Ridge rut concentration and loss of rutting habitat, potential vehicle/moose collisions on the haul road, and potential animal displacements and/or blockage of movements due to conveyor routing and port site development. Therefore, the DEIS prediction of no drastic decline is unsubstantiated. 40

The state has developed a moose monitoring program to define moose abundance so that declines may be promptly identified and steps to mitigate the decline be implemented.

Page 5-80. The possible impacts to ground water quality are briefly mentioned and reference is made to the further dilution of the leachate as it percolates and moves into surface water. However, state water quality standards do not allow for mixing zones in ground water, which invalidates the assumptions made in this section. This section should be rewritten such that compliance with state standards is achieved utilizing methods other than ground water dilution. It is likely that ground water monitoring wells will be required. 41

Page 5-85. Reference is made to the increase in sediment load due to this project. A detailed discussion is not provided regarding the impact of this additional loading on Cook Inlet. While it is understood that Cook Inlet is naturally silty, the issue still warrants review. The discussion would be improved by including information on the ambient load in Cook Inlet. 42

Page 5-86. The discussion regarding the repair and maintenance shop does not address the use and disposal of solvents. 43

Additionally, there is no mention of how oil and grease will be removed from the sediment ponds if either the oil and grease trap fails, or it inadequately removes the pollutants. 44

Page 5-114. Given the size of the potential on-site leach field for the housing and transportation facilities, further review of ground water impacts is needed. For instance, a review of soils data may be required to determine the potential for ground water contamination. As mentioned in our comments that follow on the NPDES permits, this leach field will require a Plan Review and Approval by the state. 45

Page 5-115. Table 5-27 does not include total suspended solids, dissolved oxygen, fecal coliform, or chlorine (if used) concentrations. Again, although the use of a mixing zone is presented, the justification and supporting data are not presented. 46 47

Page 5-116, Effects on Subsistence Resource Harvest. Consistent with our earlier comment, this discussion should be moved to page 5-69. 48

Page 5-117, Effects of Change in Harvest Regulations. The state agrees that increasingly restrictive harvest regulations could have significant effects on local subsistence harvests. In addition, it is worth noting that if increases in the human population on the west side of Cook Inlet occur (as predicted) and a road connection is established with the Parks Highway, the economy of the area could change to such an extent that the Joint Board of Fish and Game might wish to reclassify this area as "non-rural," similar to, for example, the Matanuska Valley or the Willow/Talkeetna area. This would in turn eliminate all subsistence fisheries and subsistence hunts which presently exist in this area, severely restricting Tyonek's opportunities to engage in traditional activities. Although the Board of fisheries could subsequently establish personal use fisheries, these generally have much reduced bag limits, and have no preference over sport or commercial fisheries. 49

Page 5-123, paragraph 2. In addition to the Three Mile site, it should be noted that in mild winters moose also utilize habitat near Congahbuna Lake. 50

Page 5-125, Cumulative Impacts. Again, the portion of this section on subsistence would be more appropriate if it were included as part of a larger section discussing all impacts on subsistence uses. 51

Chapter 6.0 Mitigation Reclamation and Monitoring. Our comments regarding the mitigation and monitoring chaper of the DEIS were included in our General Comments. The state reiterates the recommendation that the FEIS reflect the mitigation and monitoring developed previously for the mine component via the ASMCRA process. This approach lends continuity to the state and federal permitting processes while allowing the FEIS to build upon the state's previous efforts.

Toward this end, the following comments are provided on the specific mitigation options discussed in chapter 6.0. Each comment details how the state addressed the topic during the ASMCRA process and permit decision. The referenced documents are available to the FEIS preparers for review.

Many of our comments presenting detailed mitigation apply only to the mine permit area. The state continues to recommend development of appropriate mitigation for the non-mine permit area through the interagency/applicant group described in our General Comments.

We note that if the FEIS contains the terms "increased emphasis" and "decreased emphasis" when discussing mitigation options, further definition of these terms is required. 52

Page 6-4. The excerpt from Alaska Surface Coal Mining Program regulations quoted on page 6-4 is incorrectly identified as 11 AAC 90.313. The correct citation is 11 AAC 90.311(e). 53

Page 6-3 and 6-4, Soils. The Surface Mining Permit requires that Strandline topsoils and underlying soil materials be salvaged from all disturbed areas to a minimum depth of six inches, and that soils be replaced during reclamation to at least a six inch depth. See Stipulation 20, June 28, 1988 Decision; Stipulation 7, August 21, 1987 Decision, and Permit Application Vol. XVI, Section 4.10. The DEIS does not reflect the final permit stipulations, and thus is out of date. 54

Page 6-5, Vegetation. The EPA apparently has "minor concern" over particular aspects of the applicant's revegetation plan. The issues identified include the unpredictability of using nursery stock for replacement of woody plant species, and the possibility that post-mining soil moisture levels may not correspond with the requirements of proposed plant communities. Because of this, the DEIS suggests that it may be more appropriate to encourage natural plant succession than the structured landscaping approach that is currently being planned. However, the DEIS fails to evaluate whether unpredictable growth characteristics associated with woody plant nursery stock are applicable given the area in which 55 plantings will occur, and it is unclear how natural plant succession will benefit any more than landscaped plantings if soil moisture levels deviate much from conditions that exist today.

The revegetation plan currently contained in the Permit Application (Volume XVI, Section 4.11) reflects state agency comments and concerns, and addresses all of the suggestions presented in the DEIS. It would be inappropriate to require further changes in the revegetation plan at this time. Any further revisions should be deferred until the mine is in operation and experience has been gained with actual reclamation results in the field. Specific points raised by EPA were addressed during the ASMCRA review as follows:

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- Fertilization. See Permit Application Vol. XVI, page 4-170.
- Creation of Islands of Natural Vegetation. These are planned in two of the seven postmining vegetation types. Note that success of this technique cannot be predicted at this time. "Increased emphasis" is not warranted until success can be tested in the field.
- Establishment of Willows. Willows will be planted in five of the seven postmining vegetation types. See also Stipulation 11, August 21, 1987 Decision.
- Use of Non-Native Species. All of the proposed reclamation seed mixtures presently contain predominantly native species. Based on test plot results, DNR may in the future be recommending the substitution of Norcoast Bering Hairgrass (native) for Meadow Foxtail (introduced), but no change is considered appropriate at this time.
- Creation of Topographic Diversity and Ponds. A wetland restoration program was required in the Surface Mining Permit, for the initial ten years of operation. See Permit Application Vol. XVI, Section 4.19. Also see August 21, 1987 Decision, pp 18-19.
- Flexibility in Locating Postmining Vegetation Types. The Permit Application specifies that actual locations of postmining vegetation types will be based on slope and soil moisture considerations. See Permit Application Vol. XVI, p. 4-159b. See also March 5, 1987 Decision, Section IV, p. 22.

Page 6-6, Wildlife. As with the list on the preceding page, these suggested revisions to the reclamation plan have already been considered and incorporated into the Surface Mining Permit to the extent deemed appropriate. The specific points listed have been addressed as follows:

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- Creation of Wet Depressions. (see discussion under Page 6-5).
- Ecological Criteria for Locating Postmining Vegetation Types. (see discussion under Page 6-5).
- Establishment of Berry-Producing Shrubs. All of the listed species are planned to be established by sprig broadcasting. See Permit Application Vol. XVI, Table 4.11-12.
- Seeding of Additional Native Species. The alpine bluegrass and slough grass recommended in the DEIS are recent (1986) releases by the Alaska Plant Materials Center. Although these species may represent worthwhile additions to the seed mix in the future, neither grass is presently commercially available (commercial seed sources are in the process of being developed). During the review of the Surface Mining Permit, both the state and the applicant recognized the desirability of continuing to evaluate advances in revegetation technology throughout the life of the operation, with changes incorporated into the reclamation plan as appropriate. See Permit Application Vol. XVI, pp. 4-174 through 4-174a. Requiring the addition of the two grasses at this time, however, would be premature.

With respect to the recommended addition of yarrow to the seed mix, we are unaware of any commercial source of hardy Alaskan seed for this species, either existing or under development.

- Establishing Shrubs by Sprigging. This technique has not previously been employed in Alaska, but is planned for two of the seven postmining vegetation types. "Increased emphasis" is not warranted until success can be tested in the field.
- Repeat Fertilizations. Number and timing of repeat fertilizations will be determined in the field, based on the results of the annual revegetation monitoring program. See Permit Application Vol. XVI, p. 4-199b.

- Development of "Edge" Habitats. Edge habitat will be increased by creating irregular community boundaries and by overlapping plantings. See Permit Application Vol. XVI, p. 4-159b. 56

Page 6-6, paragraph 2. Performance standards for reclamation success have been established through the Surface Mining Permit, and are intended to insure that postmining land use goals of wildlife habitat restoration are achieved. See Permit Application Vol. XVI, Section 4.11.8. 57

Page 6-7, paragraph 2. With regard to the areas not previously addressed through the ASMCRA process, the state supports habitat enhancement as a form of mitigation to compensate for irreversible or long term commitments of valuable wildlife habitats. However, we believe the FEIS should specify standards based upon the information that is currently available. 58

Page 6-7, paragraphs 3, 4 and 5. We suggest that the conveyor access road, adjacent to the conveyor and main haul road, be regularly cleared of snow to encourage moose use and minimize the possibility that animals will congregate on the main haul road. 59

Page 6-7, paragraph 6. The FEIS should include documentation that birds associate large plastic balls with suspended wires and cables, or that other mitigative options are less effective in preventing bird strikes. 60

Page 6-8, paragraph 4. The proposal in the DEIS, that return flows to streams be managed to optimize downstream flow conditions, was considered during the Surface Mining Permit process and was rejected as logistically complex and technically suspect. Pumping of water to sediment ponds, and resulting discharges, will need to be managed extensively to meet state water quality standards. Imposition of minimum return flow requirements would defeat this water quality management strategy, and could result in water quality degradation. 61

Page 6-9, paragraph 2. A wetland restoration program was required under the Surface Mining Permit for the initial ten-year mine area. One of the purposes of this program is to promote ground water recharge. See Permit Application Vol. XVI, Section 4.11.9. In addition, the applicant proposes to speed ground water recharge by creating small depressions within the regraded areas, thus promoting additional ponding and infiltration of runoff. See Permit Application Vol. XVII, p. 4-207. 62

Page 6-9, paragraph 3. Throughout the Surface Mining Permit review, considerable attention has been devoted to the restoration of mined-out stream systems, and particularly to insuring that the final design reflects "an integrated effort of hydrologists and fish habitat specialists." The applicant has made numerous commitments describing how the reclaimed streams would be designed and has further agreed that specific engineering and design details, including plan maps and drawnings, will be submitted to the state through the ASMCRA permit for review and approval prior to construction. See Permit Application Vol. XVII, pp. 4-217 through 4-218a, and Vol. XV, Section 4.07.1.4. 63

For areas outside the ASMCRA permit area (to be mined during years 11-30 of the operation), the FEIS should recommend reclamation of mined-out stream systems as a mitigation option for loss of fish habitat. 64 For the entire project life, the state recommends the detailed engineering designs for stream reclamation be distributed to the interagency forum for technical review and comment as these become available. 65

Page 6-10, paragraph 2. Extensive mitigation and monitoring programs are presented throughout the Surface Mining Permit to prevent sediment or metals contamination of adjacent streams resulting from the initial ten years of mine operations. Designs are state-of-the-art, and have been subjected to comprehensive engineering reviews by the state (see final engineering report in the state's August 21, 1987 Decision). In addition, the August 21, 1987 Decision, Stipulation 6, requires a Water Quality Contingency Plan, in the event that designs do not function as predicted. Beyond the ten year mine area, the applicant has tentatively selected sediment pond locations for the life of the mine. See Permit Application Vol. XIV, Map 4.01-27. 66

Page 6-11, paragraph 3. A mitigation program, to compensate for the unavoidable loss of fish productivity resulting from the initial ten years of mine operations, has been required under the Surface Mining Permit. See Stipulation 14, August 21, 1987 Decision. 67

Page 6-14, paragraph 1, Soils. The Surface Mining Permit specifies that selected chemical and physical properties of the overburden and interburden will be monitored after the spoils are regraded, but prior to the application of topsoil. Applied topsoil will be separately monitored. See Permit Application, Vol. XVI, Section 4.10.5. 68

Page 6-14, paragraph 2, Vegetation. Annual monitoring of revegetated areas has been required under the Surface Mining 69

Permit, to determine the level of success achieved, and to identify factors responsible for positive or negative revegetation trends. Additional comprehensive sampling will be required for bond release. See Permit Application Vol. XVI, Section 4.11.8.2 and 4.11.8.4. 69

Page 6-14, paragraph 3, Wildlife. Monitoring requirements are already in place through the Surface Mining Permit which will satisfy three of the four listed monitoring objectives. Stipulation 10 of the August 21, 1987 Decision requires a moose monitoring program which will assess the effects of mining activities on the Lone Ridge rutting area. The stipulation also requires annual monitoring of wildlife use of reclaimed areas, and reporting of all moose/vehicle collisions. See also Permit Application Vol. XV, pp. 4-115f through 4-115p. 70

For the areas not covered by the Surface Mining Permit, we recommend additional monitoring programs to determine the success of habitat enhancement efforts and wildlife crossings of the conveyor. In addition, the total monitoring package will require evaluation to determine whether the monitoring is sufficient to evaluate the ongoing status of the Beluga area moose population.

Page 6-14, paragraph 4, Hydrology. The Surface Mining Permit requires continuous flow monitoring at seven locations on Lone Creek, Stream 2003 and the Chuitna River. See Permit application Vol. XVII, pp. 4-232 through 4-232e. See also Stipulation 18, August 21, 1987 Decision. 71

Page 6-15, paragraph 1, Hydrology. The Surface Mining Permit requires an annual evaluation of data collected through the surface and ground water monitoring programs, to determine whether any observed changes are consistent with predictions of probable hydrologic consequences of the operation (which would include impacts on stream baseflow). See Stipulation 17, August 21, 1987 Decision. 72

Page 6-15, paragraph 2, Hydrology. The Surface Mining Permit includes an extensive ground water monitoring program, to assess ground water impacts associated with the first 10 years of mining. Water levels, water quality, and spoil resaturation will be monitored in a total of 55 wells. See Permit Application Vol. XVII, pp. 4-233 through 4-235a. 73

Page 6-15, paragraph 3, Water Quality. The Surface Mining Permit requires extensive monitoring of the water quality of effluents from the mine drainage system, as well as monitoring of the receiving streams. This program is in many respects more comprehensive then the requirements of 74

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the draft NPDES permit. See Permit Application Vol XVII, pp. 4-232 through 4-237.

Page 6-15, paragraph 4, Biology. For the initial ten years of the mine operations, essentially all of the monitoring programs recommended in this section are required under the Surface Mining Permit. The following addresses each of the points raised in the DEIS:

- Measurements of Downstream Water Quality. Sediment-related parameters which will be monitored in the receiving streams include total suspended solids, settleable solids, and turbidity. Proposals to require monitoring of bedload and/or sediment accumulation in stream gravels were considered during the Surface Mining Permit review, but were rejected for various technical reasons. See Permit Application Vol. XVII, pp. 4-233 and 4-236.

- Rerunning Instream Flow Models. Additional instream flow modeling has been required in permit years 7 and 10. See Stipulation 13, August 21, 1987 Decision.

- Collection of Hydrologic Data on Unaffected Stream Reaches. Stipulation 18 of the August 21, 1987 Decision requires the installation of an additional continuous gauging station on Lone Creek, upstream of mine disturbances.

- Fish Evaluations. The required fish monitoring program for permit years one through ten includes adult salmon spawner surveys, juvenile salmonid distribution studies, and juvenile salmonid population estimates. See Stipulation 13, August 21, 1987 Decision, See also Permit Application Vol. XV, pp. 4-85 through 4-85a.

- Photographic Documentation of Aufeis Formation, etc. This recommendation was discussed during review of the Surface Mining Permit, but was not included as a monitoring requirement. Instead, continuous monitoring of stream and gravel temperatures has been required at three locations in Lone Creek and Stream 2003. See Permit Application Vol. XVII, p. 4-232.

- Monitoring of Fish Utilization of Created Habitats. This monitoring has been required as part of the fish habitat mitigation program. See Stipulation 14, August 21, 1987 Decision.

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Page 6-16. We request clarification of item 6.4.5 (Socioeconomic Aspects); what kind of coordination is envisioned, and why 76 will it be restricted to community officials? We believe it is inappropriate to assume that village officials will be attuned to all local concerns, and that information will always be passed on from officials to community residents. We also request that item 6.4.6 (Subsistence and Recreation) be revised to reflect coordination with and support of DFG monitoring programs. 76

Page 7-7. The address given for DACC on this page (and also on the cover sheet) is out of date and should be corrected. 77

Page 11-8, second reference. The correct title of this publication is: The Use of Fish and Wildlife Resources in Tyonek, Alaska. 78

COMMENTS ON SECTION 404 and DRAFT NPDES PERMITS

As stated in our general comments, no mention is made in either the 404 or the NPDES permits of the need for a mixing zone in conjunction with discharges from sediment ponds serving the active mine site. Both the applicant's intent to use a mixing zone and the contingency plan which must be submitted by the applicant should be described in these permits, reflecting the certification requirements of the State of Alaska to assure compliance with the Alaska Water Quality Standards. Additional comments on the draft NPDES permits follow. Unless noted, the comments apply to all four of the draft NPDES permits. 79 80

1. The proposed levels of oil and grease appear high given the source is incidental oil from the operation of heavy equipment. If the levels are expected to be a 10-15 mg/l oil and grease, a hydrocarbon limit would be more appropriate. 81

2. Limitations for flow, fecal coliform and chlorine (if appropriate) should be set for all sanitary waste discharges. 82

3. References to "trace amounts" of floating solids, visible foam and oil & grease should be removed. In accordance with Alaska Water Quality Standards the statement should read, "There shall be no discharge of floating solids, visible foam or oil & grease which causes a sheen on the surface of the receiving water." 83

4. Chemicals and detergents are frequently used by equipment operators to wash down equipment. Additionally, solvents/degreasers are frequently used in maintenance shops. The regulation of use of such chemicals should be addressed in the permits by requiring review and approval of the specific chemicals by EPA and DEC. 84

5. "Cessation of the precipitation event" should be defined. 85

6. The limitations in the permits for iron, TSS, pH, and settleable solids are in accordance with EPA's Final Effluent Limitation Guidelines for the Coal Mining Point Source Category (40 CFR 434.45 and 434.63). However, the Alaska Water Quality Standards (18 AAC 70) which include the Quality Criteria for Water (EPA 440/5-86-001) are still applicable and in some cases are more stringent than 40 CFR 434. Additionally the state standards apply under all conditions including baseflow and all precipitation events as referenced in the permits. Therefore, the permits should include references to application of mixing zones for these parameters, as well as turbidity, in order to meet state standards. 86

7. The draft permits specify a required monitoring program for sampling settling pond effluent during baseflow conditions. The permits require weekly sampling for most of the listed parameters. However, monitoring of effluent flow is required on a daily basis. This is a change from the previous draft permits which specified weekly flow measurements. In developing required monitoring via the ASMCRA review the state found that daily flow monitoring is logistically difficult, expensive and, because the other water quality parameters are only sampled weekly, provides no additional assurance that effluent limits are being met. The state Surface Mining Permit reflects our finding that weekly monitoring of flow is sufficient and we recommend that EPA revise the NPDES permits to reflect weekly monitoring. 87

8. Each of the four NPDES permits includes authorizations for discharge of both domestic and nondomestic wastewater. State regulations require approval of domestic wastewater systems to ensure discharges from these systems will meet state water quality standards. The mechanism for this approval is the applicant's submittal of engineering plans for DEC technical evaluation and approval. Prior to receipt, review, and approval of these plans, DEC cannot be certain that the domestic discharges will meet state water quality standards. Therefore, DEC cannot issue the required 401 Certificate for the NPDES permits until the system plans have been approved. 88

Additionally, state regulations require DEC plan approval of nondomestic wastewater systems (i.e. sediment ponds). Detailed plans for nondomestic systems within the mine 89 permit area were submitted via the ASMCRA permit application. However, plans for the sediment ponds outside the ASMCRA permit area have not yet been submitted to DEC. Again, prior to DEC plan approval, the DEC 401 Certificate cannot be issued.

Throughout the Phase 1 permitting DEC has notified DACC of this requirement. DACC has recently contacted DEC regarding this. With prompt submittal of the required plans, DEC plan approval and preparation of the 401 Certificates could be accomplished such that a delay in issuance of the NPDES permits is not necessary. 89

The following comments are specific to the two permits listed:

AK-004357-5 - Coal Mine

- Part I. A.2.a. & b. Sampling of TSS, oil and grease (hydrocarbons), and iron should be maintained as proposed previously in draft permits. 90

AK-004356-7 - Housing

- Part I.B. If the housing area is designed properly, there should be no need for sediment ponds. This needs to be addressed before permit issuance. 91
- Part I.B. TSS limits differ from the other permits. If sediment ponds serve only housing areas, (storm water) comparing it with Alaskan ore mining, or placer mining is inappropriate. 92

CONCLUSION

This concludes the state's comments on the DEIS. We look forward to working with EPA and the COE on resolution and refinement of the issues identified and review of an FEIS and NPDES and COE permits which reflect this effort. As we discussed, DGC is available to EPA and the document preparers to provide any further information on these comments and to intitiate coordinated resolution of the mitigation program.

We appreciate the opportunity to comment on the DEIS and to work with EPA toward consistency between the federal and state permitting processes and decisions for the Diamond Chuitna Project.

Sincerely,
Patty Bielawski
Patty Bielawski
Project Review Coordinator

co7/75

cc: Dan Harlow
Diamond Alaska Coal Company

Carol Gorbics
U. S. Army Corps of Engineers

Bill Lamoreaux
Department of Environmental Conservation

Dan Wilkerson
Department of Environmental Conservation

Julie Howe
Department of Environmental Conservation

Sam Dunaway
Department of Natural Resources

Carol Pahlke
Department of Natural Resources

Judith Bittner
Department of Natural Resources, SHPO

Lance Trasky
Department of Fish and Game

Mark Kuwada
Department of Fish and Game

BELUGA COAL COMPANY

September 8, 1988

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REGION 10

Mr. Rick Seaborne
EIS Project Officer
Environmental Protection Agency, WD-136
1200 Sixth Avenue
Seattle, WA 98101

Re: Diamond Chuitna Coal Project

The following comments address statements made in Section 3.2.2.1 (pages 3-9 and 3-12) of the Draft EIS of the Diamond Chuitna Coal Project. Specific attention is directed to comments therein regarding North Foreland as a possible site for the coal port considered in this project.

The North Foreland location has an existing pier (now known as the Tyonek Pier) which was used from 1975 to 1983 to load wood chips on ocean-going vessels as large as 40,000 DWT. This pier has been determined to be in good condition by consultants employed by Tyonek Native Corporation and Beluga Coal Company.

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Subsequent to the 1986 analysis of the Tyonek Pier by Soros Associates, the Beluga Coal Company engaged various marine and engineering consultants who have provided our company with more recent technical information on the tidal currents and ice conditions at the North Foreland site. In addition, preliminary design for a 1,000 foot pier extension has been made which will accommodate PANAMAX size vessels requiring a draft of 50 feet of water.

With the anticipated construction of this pier extension, it is evident that the limitations of the existing pier are academic, inasmuch as fender systems, structural adequacies for a travelling shiploader, and any other requirement for loading of large vessels will be included in the new facility. The increased depth of water at the end of the pier extension will resolve concern about of sedimentation at the berth. The pier extension and new berthing wharf will be properly positioned to achieve the optimum alignment for the dominant direction of ebb and flood currents.

The work performed for the Beluga Coal Company between 1986 and 1988 on pier extension, tidal current and ice forces, and on materials handling requirements, confirm that the new North Foreland facility, having a total length of 2,440 feet and a 750 foot berthing wharf, will have a capacity to load 12,480,000 metric tons per year with a 57% time utilization of the berth. In the marine bulk terminal industry, this percentage utilization is considered a conservative operating factor when measured against normal berth availability; optimal design for bulk terminal berth availability is approximately 68%.

The Beluga Coal Company anticipates shipments over this new facility of up to 5,000,000 metric tons annually. However, the combined volumes of both Beluga and Diamond Chuitna's additional projected 10,900,000 metric tons per year would exceed the currently anticipated design capacity of the extended Tyonek pier.

Sincerely yours,

Noel W. Kirshenbaum

NWK:ea

TYONEK NATIVE CORPORATION
4433 Lake Oils Parkway
Anchorage, Alaska 99507
(907) 563-0707

September 8, 1988

Mr. Rick Seaborne
Environmental Protection Agency, WD-136
1200 Sixth Avenue
Seattle, Washington 98101

Re: Diamond Chuitna Coal Project, Draft Environmental Impact Statement

Dear Mr. Seaborne:

Tyonek Native Corporation ("TNC") owns a port site and dock at North Foreland, near Tyonek, Alaska. TNC has tried to encourage potential users to consider this facility for their needs. One of the possible uses of this port site would be shipment of coal from the Diamond Chuitna Coal Project. TNC has discussed this possibility with Diamond Alaska Coal Company, but has been unsuccessful in attracting Diamond's interest in North Foreland.

There was some discussion of the North Foreland site in the Diamond Chuitna Coal Project Draft Environmental Impact Statement. We would like to comment on this.

According to the Draft EIS, three port site options were considered, including TNC's North Foreland. We would like to know whether or not all three port sites were uniformly evaluated, using the same evaluation methods and standards. 1

The pier at North Foreland was constructed for shipment of wood chips and, as it is presently configured, would obviously be inappropriate for a large volume coal project. Ladd and Granite Point neither have port facilities, and therefore both sites would require construction of new facilities from scratch before coal could be shipped from either site. The North Foreland site, with its existing facilities already in place, would simply require modification to these existing facilities in order to ship coal. 3

The use of existing facilities (roads, dock, housing, etc.) at North Foreland would therefore appear to be cheaper and less environmentally damaging than new construction at Granite Point or Ladd. It is unfortunate that the analysis neglected to mention that modifications could be made to the North Foreland facility, enabling the pier and site to handle large volumes of coal. We believe that the North Foreland site should be considered a viable transportation alternative for the Diamond Coal Project. 2

Sincerely,

TYONEK NATIVE CORPORATION

John Evans
Executive Director

JKE:sm/crr.52

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Trustees for ALASKA

September 14, 1988

Rick Seaborne
EIS Project Officer
Environmental Evaluation Branch, M/S WD-136
Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

Re: Diamond Chuitna Coal Project EIS, Draft NPDES Permits and 404 Permit

Dear Mr. Seaborne:

Enclosed are the comments of Trustees for Alaska and the Alaska Center for the Environment on the Diamond Chuitna Coal Project EIS, NPDES permits and 404 permit. We thank you for granting us a two day extension of the August 13, 1988 deadline.

We would appreciate hearing your response to our comments.

Very truly yours,

Patti J. Saunders

Patti J. Saunders
Staff Attorney
Trustees for Alaska

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Cliff Eames/pjs

Cliff Eames
Issues Director
Alaska Center for the Environment

cc: Julie Howe

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TRUSTEES FOR ALASKA AND ALASKA CENTER FOR THE ENVIRONMENT'S COMMENTS ON THE DIAMOND CHUITNA COAL PROJECT

I. The Draft Environmental Impact Statement

The National Environmental Policy Act ("NEPA") requires that an environmental impact statement ("EIS") evaluate the potential environmental effects of federal actions and identify alternatives to the proposal. The Draft EIS for the Diamond Chuitna Coal Project does not satisfy NEPA's requirements, since its analysis is not thorough and is replete with factual inaccuracies, miscalculations, and unjustified assumptions. Following are some of the more glaring problems we have identified.

A. Alternatives

The discussion of alternatives is inadequate. For starters, the DEIS makes assumptions like "[there is] only one option [for the mine] since the coal deposit, and therefore the mine location, was fixed." DEIS p. 3-1. The DEIS completely ignores the possibility that the mine site could indeed be adjusted. Obviously, a coal mine will be located only where there are coal reserves, but the coal leases held by Diamond extend far beyond the areas planned for mining. Thus, it would be not at all impossible to revise the boundaries of the mine. And if doing so would avoid or mitigate environmental effects, the DEIS's failure to consider these alternatives is a serious flaw in the NEPA process. 1

Two examples of the potential importance of alternate boun-

major rutting area for the Lone Ridge moose herd and quality and quantity impacts on the Chuitna watershed. It is possible that either or both of these could be avoided or mitigated by adjusting the mine's boundaries.

A second major failure in this regard is the DEIS's failure to consider timing changes as an alternative. Diamond plans to open large pits and cuts and keep them open as necessary in relation to market demands. 2 The DEIS should have considered whether a less grandiose mining scheme (or a more vigorous and timely reclamation plan) that would disturb less land over a given period of time and reclaim it more quickly would avoid or mitigate impacts.

Essentially, the DEIS is limited to consideration of the mine plan as proposed by the applicant, rather than on the searching and thorough analysis envisioned by NEPA.

B. The haul road seems to be unnecessarily wide. Why are 35 foot wide lanes and 12 foot wide shoulders required? The total width of the road including lanes, shoulders, embankments, 3 and ditches appears to be about 110 feet -- more than enough for a four lane divided highway! The plan appears to be unnecessarily wasteful of gravel resources, and will result in the clearing of much more land than necessary, and increasing the magnitude of the difficult task of reclamation.

C. The conveyor and road corridor seems unnecessarily wide. A 200 foot wide "greenbelt" is apparently planned between the road and the conveyor. Diamond apparently plans to clear this 200 foot wide strip of timber for the 11-13 mile length of the corridor. The total width of the cleared strip containing the roads and the conveyor is almost 400 feet. There is no apparent justification for this wasteful use of resources and unnecessary negative impact on the environment. 4

D. The installation of a second road alongside the conveyor in addition to the superhighway 200 feet away does not appear to be justified. Diamond indicates that the conveyor access road is needed to allow maintenance of the conveyor so as not to interfere with haul road operations and vice versa. When the conveyor is in operation, there should be no need for use of the haul road. This inconsistency must be resolved. 5

E. Fugitive dust emissions from the conveyor do not appear to have been properly addressed. Total annual emissions from this source are estimated at 8.4 tons per year, while total annual emissions for the coal stockpile to which this belt delivers were estimated at 218.1 tons per year, or 26 times more at the stockpile. We believe that the conveyor emissions will be at least as high as the stockpile and probably higher. Moreover, this calculation is based on 99 trips per day even though Diamond is planning on 311 trips per day.[1] This calculation must be reworked based on the mine plan's projections, rather than assumptions unrelated to reality. 6

Moreover, the DEIS, in addition to the miscalculation of fugitive emissions, makes the unwarranted conclusion that partially enclosed conveyors will "minimize" dust emissions (DEIS p.2-46). Unless the conveyors are totally enclosed, which we heartily endorse, emissions will not be minimized, only somewhat lessened. 6

F. Temporary overland truck coal haul fugitive dust emission calculations appear to be incorrect. The calculation assumptions do not consider the size and peripheral velocity of the wheels. This calculation is grossly in error and will be much greater than what is claimed. This calculation is also improperly based on 99 trips a day, even though Diamond is planning on 311 trips per day. 7

G. Exhaust emissions from temporary truck coal haul appear to be calculated incorrectly. The gallons per hour fuel consumption number is incorrect. The number of trips per day is incorrect. 8

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[1] Actually, it is not clear whether the actual figure is 311 or 331. Cf. DEIS p. 3-6 and 3-19. However, it is certainly not 99.

H. There are a number of other errors and inconsistencies in the segment of the DEIS on dust emissions. The wind speed data for different sites is presented with different units: Granite Point and the mine site's wind speeds are displayed in meters per second, while the Anchorage and Kenai data are displayed in knots. This makes comparison difficult. 9

The validity of the emissions calculations based on nominal wind speeds of four to six miles per hour is doubtful. Examination of the Granite Point data shows that, during the winter, winds from the north and NNE average 4.1 meters per second (13.1 feet per second, or 12.8 MPH) for 58% of the winter season. The conveyor from Granite Point will return directly against the wind, thus adding its 5.08 meter velocity (14.7 MPH) to the wind velocity, for a combined relative velocity of 27.5 MPH. 10

Under these conditions the conveyor will be returning empty with loose dust on the conveyor, which will not be covered underneath. Prevailing winds in the fall, winter and spring are from the N-NE approximately 70% of the time at Granite Point and about 65% of the time at the mine site. Thus, the calculations of dust emissions have been seriously underestimated and the environmental impacts concomitantly discounted.

This is a serious flaw. It must be rectified in order to comply with NEPA.

I. The DEIS states that the Tuxedni National Wildlife Refuge is the game refuge closest to the mine site. This is incorrect. The Kenai National Wildlife Refuge is closer. Additionally, two State Game Refuges at Beluga Flats and at Tyonek are within 15 miles of the proposed mine site and within 5 miles of the proposed conveyor route. 11

J. The DEIS repeatedly states (e.g., p. 2-45) that drainage from shops, vehicle washdown areas, etc., will be routed to sediment ponds with treatment facilities. However, according to Figure 2-4, the sediment pond closest to the mine service area and vehicle parking/storage area will not have a treatment facility. This appears to be a significant discrepancy of serious concern, given the number of trucks and other vehicles to be used at this site. 12

K. Dust suppression chemicals are mentioned at several points without ever defining exactly what these chemicals are. What are they? What will be their effect on the environment? How much and how often will the chemicals be used? What will be the effect of these chemicals on local groundwater? On local streams? On wildlife? On fish? 13

L. Forested buffers should be maintained around coal stockpiles to minimize as much as possible the effects of winds. 14

M. How are coal stockpiles to be protected from forest fires? 15

N. Why is sewage sludge being buried in the mine pit rather than being incinerated? 16

O. The DEIS seems to lack any discussion of the potential water quality impacts of coal spillage from the trestle and barge loading area into the ports, which is inevitable, given that the facility will not (in its present form) be totally enclosed. The DEIS's failure to consider this and require mitigation is a serious flaw, since spillage of even a very small percentage of twelve million tons of coal a year could have very significant impacts on water quality and aquatic life. 17

P. The DEIS's failure to consider the applicability of the Clean Water Act's antidegradation requirement to this project is a significant flaw in the analysis. 18

Q. On p. 2-14, the DEIS states that the sewage generated at the mine facility will be treated and then piped over to the housing camp, where it will be discharged along with the sewage from the camp. Why then is Outfall 019 for sewage from the mine site (Draft Permit AK 004357-5)? 19

R. The DEIS's conclusions about compliance with Alaska water quality standards are based on inaccurate assumptions and must be rethought. For instance, Alaska's standard for pH is between 6.5 and 8.5, with a maximum change of 0.5 from natural conditions, not 6.5 to 9.0, as stated in Figure 5-7. Also, while Figure 5-7 assumes the standard for dissolved solids is 500, 18 AAC Chapter 70 clearly states that the standard is a maximum of 1500 mg/l including natural amounts, but in no event greater than 1/3 higher than natural conditions. These are only the most glaring errors. The entire figure should be carefully and accurately redone. 20

Even as it stands, however, Figure 5-7 shows that Alaska's water quality standards will be violated. For example, it is estimated that dissolved solids in the effluent will be as high as 200 mg/l, while the maximum receiving water quality is 104 mg/l. Thus, the discharge will far exceed the 1/3 allowable increase on some undefined frequency. And this is one of the parameters the DEIS does not project for exceedances, while there are at least several others that are. The DEIS does not even attempt to reconcile this prediction of potential violations of water quality standards with the favorable evaluation given to this project. Beyond this failure of the DEIS, it is, of course, unlawful for EPA to issue NPDES permits that will violate water quality standards. 2

The same sort of analysis done here for surface water also applies to the DEIS's poorly analyzed groundwater section.

S. The DEIS is completely silent about the excessive destruction of wetlands associated with this project. Many of the 2 facilities associated with this project could be, and therefore must be, redesigned to minimize their impact on the wetlands in the area. For instance, the housing layout proposed is very inefficient and wasteful of resources. The footprint of this facility can be decreased by 50%, thereby minimizing the wetlands acreage that will be destroyed. The DEIS's failure to consider these impacts and to require their mitigation is a serious flaw that must be rectified if this project is to comply with NEPA. 21

II. Draft NPDES permits AK-004357-5, AK-004356-7, AK-004331-1, and AK-004685-0

A. None of the draft permits include provisions for a Best Management Plan, as required by the Clean Water Act. 22

B. Effluent Limits

1. The permits do not include water quality based limits, as is required by Section 402 of the Clean Water Act. This is a serious omission that must be corrected before permits can be issued. Specifically, we are concerned about the failure to include limits for fecal coliform and chlorine residual for the sanitary waste discharges, and the pollutants of concern listed in the DEIS in Figures 5-7 and 5-9. In addition, some of these parameters ought to be included in the permit under technology-based considerations since they are found in the discharge. EPA has completely ignored the requirement of the Clean Water Act to t effluent limits for the toxic pollutants in these discharges 23

(such as, for instance, the metals). If they are not included in EPA's effluent guidelines, then limits must be set using best professional judgment of best available technology.

In accordance with 18 AAC 70.020, the following parameters must be added to those listed in the draft permits: 23

1. Fecal Coliform
2. Dissolved oxygen (greater than 7 mg/l for an anadramous stream)
3. pH range between 6.0 and 8.5 (not 9.0), with a maximum change of 0.5 from natural conditions
4. Turbidity
5. Temperature
6. Total Dissolved Solids
7. Sediment
8. Toxic and Other Deleterious Organic and Inorganic Substances
9. Oil and Grease to all outfalls
10. Radioactivity (Radium 232 is a common constituent of coal).
11. Total Residual Chlorine (2 ug/l in salmonid waters)
12. Color
13. The stipulations specifying 85% removal of BOD5 and TSS do not appear to be in conformance with Alaska Water Quality Standards.

B. The permits must be revised to include provisions for compliance with the zones of deposit requirements of 18 AAC 70.033. 24

C. It is unreasonable of EPA not to set maximum flow limits for the sanitary waste discharges, based on the capacity of the treatment facilities. Thus, for the housing camp discharge, the flow limit should be 30,000 gpd, which is the capacity of the package plant Diamond intends to install. Failure to do this opens the possibility of overloading the system and resultant violations of other limits. 25

D. EPA's failure to apply the antidegradation requirement of the Clean Water Act to this virtually pristine water system violates the Clean Water Act. 26

E. It is not at all clear why Outfall 019 is necessary if the DEIS is correct in stating that the sewage from the mine site will be piped over to the housing camp to be mixed with the camp sewage and discharged there. 27

III. 404 Permit

Diamond's proposed facilities are not well designed to minimize the incursion on wetlands. Given the size of this project and the amount of wetlands to be filled, such considerations must be incorporated into the project. We realize that some wetlands will, of necessity, be destroyed if this project is to go forward, but there is no justification for permitting the destruction of more wetlands than necessary. Diamond must be required to redesign these facilities to minimize wetlands destruction. 28

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REGION 10

Box 5
Beluga, Ak., 99695
September 8, 1988

Rick Seaborne
EIS Project Officer
Environmental Evaluation Branch, M/S WD-136
EPA
1200 6th Ave.
Seattle, Washington

Dear Mr.. Seaborne:

Enclosed please find some comments of the Draft Environmental Impact Statement for Diamond Chuitna Coal Project. These comments are general - concerning the project in broad terms - and specific - referring to particular pages or section numbers in the EIS.

Thank you,

Tamara Said

enc.

cc: Trustees for Alaska
Kenai Peninsula Borough Assembly members

DIAMOND CHUITNA COAL PROJECT

EIS COMMENTS

Chapter Two (Proect Overview)

Proposed Transportation Options:

1. Northern/Ladd route contains two crossing of Three Mile Creek (The only Sockeye Salmon spawning grounds in the area at Three Mile Lake). This stream is spawning grounds for Sockeye, Silver, Chum and Pink salmon as well as home for trout and other fishes, waterfowl, including loons and swans. This route also crosses Lone Creek (spawning grounds for rainbow and Dolly Varden trout and various species of Salmon). 1

2. Eastern/Ladd route crosses Lone Creek, goes near Viapan Lake and through the surrounding wetlands (nesting area for swans, terns, cranes, loons and other waterfowl). 2

3. Southern/Granite Point route crosses Chuit and old Tyonek Creek (major spawning grounds for salmon) and wetland areas. 3

Location and Size of Mining Area:

The entire west side of Cook Inlet has the soft, lowgrade coal to be mined by Diamond Chuitna. Does this mean that the entire west side should be mined? Other sources of cheap, more environmentally-sound energy supplies are available without destroying virgin timber(for the most part), wetlands, salmon spawning streams, large game habitat, to say nothing of the destruction to our atmosphere when this energy source is used.. 4

Revegetation:

Wetlands can not be revegetated as wetlands. 5

Run-off:

EIS statements on runoff are accurate; the mine area would not receive runoff but would cause polluted runoff to lower elevations.. 6

2-9 "[treated water] would be released from the ponds into natural drainages" to go into streams changing water temperature and density, regardless of treatment. Note this which admits that treatment will not clean the water: "the sediment ponds would be dredged periodically..." 7

2-19 drawing and details of port facilities show only the Granite Point option.. Details should be shown for all options. 8

2-31 (stockpiles) "All stockpiles would be located within the mining limit..." This is untrue according to lease options from Kenai Peninsula Borough.. Coal would be stockpiled around Viapan Lake and Ladd Landing.. No EIS on this has been done. 9

Table 2-1 Diamond Chuitna would "minimize use of construction and mining in streams other than those designated for mining." Those designated for mining include major trout and salmon rearing grounds. 10

2..11.1 "At lower production levels not requiring ships, barges would be berthed at the Ladd trestle for up to approximately two hundred days per year." Ladd option is stated only as an option without complete EIS for various environmentally aspects. Also note that two hundred days is almost 2/3 of one year. 11

2.11.4 (Slash burning) Anchorage area suffers enough from air pollution already without slash burning of this magnitude with or without favorable weather conditions.. The atmosphere as a whole would suffer. 12

2.11.6 (environmental coordinator) It seems reasonable (sane) to have this person stationed on-site to coordinated environmental safety, not in Anchorage to ensure the paperwork gets done expeditiously. 13

3.2.1.3 (transportation) Six options were listed but there is no EIS on each with pros and cons and the most environmentally sound option (piped slurry) is summarily dismissed at that point. 14 15

3.2..1.4 This discusses the loading facility as if transportation option #6 - the conveyor- were the only option. 16

Table 3.2 lists possible environmental hazards to options not chosen but does not list the envitonmental hazards of option 6. This table also shows that North Foreland port location was eleminated.. Actual blasting by Northern Geophysical (August 30 -- September 9, 1988) shows that only the northern transportation route is now an option. 17 18

Table 3.6 has a cursory look at some transportation modes and states that a road would have high adverse impact. Coal company officials have stated in public meeting that a road will be used for coal transportation for some time. 19

Table 3-9 has matrix listing impact of three transportaion corridors.On this table the Eastern/Ladd is shown to have the least negative impact. However, blasting by Northern Geophysical for Diamond Chuitna has shown that the Northern/Ladd route is the preferred option at this point 20

"While the overall potential for adverse impacts was judged higher for the northern/Ladd alternative, it was not a clear cut difference." (3-35) This is a value judgement not based on fact. 21

4.4.4.2 (fish) "At present resident species are not significantly exploited in the project area." Fish (trout and salmon) that are fished elsewhere use that mining area at some time in their lives as spawning or rearing areas. 22

4-38 to 4-41 Documentaries of salmon in 1983 and 1984 by Alaska Department of Fish and Game did not typify subsequent years of salmon returns.. This underestimates the proliferation of fish. 23

4.6.2 Air quality studies were done in already polluted areas and not in mining and transportation areas. 24

4.7.2.5 (Community attitudes toward Diamond Chuitna) No survey of local residents and land owners was done. Value judgements were made. Thus, I will make another: Tyonek residents' prime concern is the destruction of moose and fish populations and habitat. Beluga area land owners and residents were not mentioned in the EIS. 25

5.3.1.5 (wildlife) Habitat loss- a value judgements was made as to the relative import of the loss. 26

5-12 (wildlife) "In unusual cases, they may be killed." (6.31.3) This can be constued as a way to defend killing of moose and bear for sport and meat. 27

5.3.2 (water quality) Diamond Chuitna officials have stated that water quality will suffer

5.3.3 (Marine Environment.) "There would be no impacts to the marine environment associated with the mine and mine facilities." As mining affects streams and surface and ground water, it would affect marine environments. The water cycle and air currents would ensure that marine and all other environments would be affected. 28

5.3..4.1 (emissions) The state has petitioned to change its emissions standards. Could that have been to allow this mining to go on? 29

Chapter 11.0

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Chapter 12.0

Glossary of Technical Terms, Acronyms, Abbreviations, and Measurement Equivalents

12.0 GLOSSARY OF TECHNICAL TERMS, ACRONYMS, ABBREVIATIONS AND MEASUREMENT EQUIVALENTS

12.1 DEFINITION OF TERMS

Note: The terms defined here have been marked with an asterisk (*) throughout the text.

Term	Definition
Alluvium	Clay, silt, sand, gravel, and similar unconsolidated detrital material deposited recently (in geologic time) by a stream or other body of running water in the bed of the stream or on its flood plain or delta, or as a cone or fan at the base of a mountain slope.
Alevin	A newly hatched salmon still attached to the yolk sac.
Anadromous	Fish (like salmon) which hatch and often rear for varying periods in freshwater, migrate to the sea for one or more years of accelerated growth, and return to freshwater to spawn.
Andesite	A dark-colored, fine-grained extrusive rock.
Antecedent Moisture Condition	The amount of moisture present in the soil at the beginning of a runoff period.
Anticline	Layered rock strata that have been folded into an arch-shaped structure in which the layers incline away from a central axis. (opposite of syncline).
Aufeis	Massive surface ice formed by successive freezing sheets of water seeping onto ice cover from stream banks, under the ice or from surface runoff.
Base Flow	Sustained or fair-weather flow of a stream.

Term	Definition
Batholith	A generally discordant, plutonic mass that has more than 100 square kilometers (40 square miles) in surface exposure and is composed predominately of medium to coarse rocks of granodiorite and quartz monzonite composition.
Benthic	Pertaining to that which occurs at the bottom of water bodies; especially applies to organisms living on or in bottom sediments.
Borrow	Construction materials such as sand and gravel.
Box Cut	Initial excavation for mine development.
Breccia	Coarse-grained clastic rock composed of large (greater than sand size), angular, and broken rock fragments that are cemented together in a fine-grained matrix.
Cache	Food storage pile.
Confined Ground Water	An aquifer in which the water is under pressure between two impermeable layers of subsurface material such as rock or clay.
Deltaic Deposits	Sedimentary deposits laid down in a delta, characterized by well-developed local cross-bedding and by a mixture of sand, clay, and the remains of brackish water organisms and organic matter.
Detritivore	Animals which feed on decaying material, especially at the bottom of water bodies.
Embayment Deposits	Materials deposited in a deep recess or indentation in a shoreline; generally fine-grained materials such as clay, silt, and sand.

Term	Definition
Epibenthic	That which occurs on the surface of sediments at the bottom of water bodies.
Epibiotic	Pertaining to organisms living on the surface of bottom sediments.
Escapement	The number of anadromous fish which return to freshwater streams and successfully spawn.
Estuarine Deposits	A sedimentary deposit laid down in the brackish water of an estuary, characterized by fine-grained sediments (chiefly clay and silt) of marine and fluvial origin mixed with a high portion of decomposed terrestrial organic matter.
Extrusive Rocks	Rocks that have been ejected onto the surface of the earth; e.g., lava flows, volcanic ash.
Facies	Any observable attribute or attributes (e.g., overall appearance, composition, or conditions of formation) of one part of a rock as contrasted with another or several other parts of the same rock.
Fluvial Deposits	Sedimentary deposits consisting of material transported by, suspended in, or laid down by a river or stream.
Granodiorite	Coarse-grained plutonic rocks containing quartz, plagioclase, and potassium feldspar, with biotite, hornblende, or, more rarely, pyroxene.
Heuristic	Providing aid or direction in the solution of a problem but otherwise unjustified or incapable of justification.
Igneous	Rock which has solidified from molten lava.

Term	Definition
Infauna	Community of organisms which live within sediments at the bottom of water bodies.
Interburden	Soil or other material lying between coal seams.
Intrusive Rocks	Rocks emplaced by the intrusion of lava into pre-existing rocks.
Loess	An unconsolidated, homogeneous blanket deposit of fine-grained materials, predominately composed of silt.
Moraine	A mound, ridge, or other distinct accumulation of unsorted unstratified glacial drift, predominately till, deposited chiefly by direct action of glacial ice.
Natality	Birthrate.
Orographic	Associated with or induced by the presence of mountains.
Overburden	Soil, rock, or other material overlying the upper most coal seam.
Palustrine	Pertaining to materials deposited in marshes.
Periphyton	Organisms, including algae, which live attached to underwater surfaces.
Piezometric Surface	An imaginary surface representing the static head of ground water and defined by the level to which water will rise in a well. A water table is a particular piezometric surface.

Term	Definition
Plutonic Rocks	Rocks formed at a considerable depth by crystallization of magma or by chemical alternation; characteristically medium- to coarse-grained and of granitoid texture.
Primary Productivity	Pertaining to organisms such as green plants which have the ability to use light and nutrient energy to manufacture food.
Pyroclastic Rocks	Rocks that are composed of materials fragmented by volcanic explosion; characterized by a lack of sorting and variability in the size of individual pyroclasts.
Recharge	Absorption and addition of water to the zone of saturation.
Redd	A gravel spawning nest constructed by salmon.
Richter Magnitude	The range of numerical values of earthquake magnitude.
Riparian	Located on the bank of a water body.
Riprap	A layer of large, broken rock placed together irregularly to prevent erosion of embankments, causeways, or other surfaces.
Rut	Mating season, especially for big game animals such as moose.
Seismic Risk Zone	One of the zones identified in the Uniform Building Code which is used to determine building construction requirements.
Series	Composed of soils having similar arrangements of horizons and having, within certain limits, similar physical and chemical properties.
Splitter-Hopper	A hopper facility capable of directing coal to more than one destination.

Term	Definition
Stamukhas	Sea-ice that has been built up (thickened) by addition of layers of sea-ice being deposited during higher tides over sea-ice layers that have frozen to a tidal flat during earlier lower tides.
Stringer	A very thin, filamentous vein of ore.
Sub-bituminous	A black coal intermediate in rank between lignite and bituminous coals; higher carbon and lower moisture content than lignite.
Succession	Changes in the plant communities composing an ecosystem as the ecosystem evolves from one type to another, e.g. wetlands becoming grassy meadows.
Sump	A pit which collects water to be pumped at the bottom of the mine.
Syncline	Layered rock strata that have been folded into a trough-shaped structure in which the layers incline towards a central axis; opposite of an anticline.
Unconformity	A substantial break or gap in the geological record where a rock unit is overlain by another unit that is not next in stratigraphic succession.
Volcanic Rocks	Generally finely crystalline or glassy igneous rock resulting from volcanic action at or near the Earth's surface, either ejected explosively or extruded as lava.

12.2 AGENCY ACRONYMS AND ABBREVIATIONS

Federal Agencies

ACHP	Advisory Council on Historic Preservation
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
Corps	Army Corps of Engineers
DA	Department of the Army
DOI	Department of the Interior

EPA	Environmental Protection Agency
FWS	Fish and Wildlife Service
MSHA	Mining Safety and Health Administration
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NWS	National Weather Service
USGS	United States Geological Survey

State of Alaska Agencies

ADF&G	Alaska Department of Fish and Game
AEIDC	University of Alaska, Arctic Environmental Information & Data Center
DEC	Department of Environmental Conservation
DGGS	Division of Geological and Geophysical Survey
DNR	Department of Natural Resources
DOT/PF	Department of Transportation & Public Facilities
SHPO	State Historic Preservation Office

Other

ANCSA	Alaska Native Claims Settlement Act of 1971
ANILCA	Alaska National Interest Lands Conservation Act of 1980
ASMCRA	Alaska Surface Mining Control and Reclamation Act
BACT	Best Available Control Technology
CINA	Cook Inlet Native Association
CIRI	Cook Inlet Region, Inc.
KLM	Kodiak Lumber Mill
KPB	Kenai Peninsula Borough
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NVT	Native Village of Tyonek
ORV	Off-road Vehicles
PSD	Prevention of Significant Deterioration
ROD	Record of Decision
SPCC	Spill Prevention, Control and Countermeasure Plan
TNC	Tyonek Native Corporation
VQO	Visual Quality Objective
VRM	Visual Resources Management

12.3 METRIC/ENGLISH MEASUREMENT, ABBREVIATIONS AND EQUIVALENTS

Metric Unit (Abbrev.)	Equivalent	English Unit (Abbrev).
centimeter (cm)	2.54 cm = 1 in	inch (in)
meter (m)	0.3048 m = 1 ft	foot (ft)
kilometer (km)	1.6093 km = 1 mi	mile (mi)
hectare (ha)	0.4047 ha = 1 ac	acre (ac)
square kilometer (km^2)	2.590 km^2 = 1 mi^2	square mile (mi^2)
liter (l)	3.78541 = 1 gal	gallon (gal)
cubic meter (m^3)	0.0283 m^3 = 1 ft^3	cubic feet (ft^3)
cubic meter (m^3)	0.7646 m^3 = 1 yd^3	cubic yard (yd^3)
cubic dekameter (dam^3)	1.2335 dam^3 = 1 ac-ft	acre-foot (ac-ft)
cubic meter per second (m^3/s)	0.0283 m^3/s = 1 ft^3/s	cubic feet per second (ft^3/s)
kilogram (kg)	0.4536 kg = 1 lb	pound (lb)
metric ton (Mt)	0.9072 Mg = 1 ton	short ton (2,000 lb)
meter per second (m/s)	0.5144 m/s = 1 knots	knot (knot)
meter per second (m/s)	0.3048 m/s = 1 ft/s	feet per second (ft/s)
miligram per liter (mg/l)	1.0 mg/l = 1 ppm	part per million (ppm)
degrees Celsius (°C)	(1.8x°C)+ 32 = °F	degrees Fahrenheit (°F)

12.4 OTHER MEASUREMENTS AND ABBREVIATIONS

acre-feet (ac-ft)
barrels (bbls)
Before Present (B.P.)
decibel level A (dbA)
dead weight ton (dwt)
megawatt (MW)
Kilovolt (KV)
parts per billion (ppb)
parts per million (ppm)
gallons per day (gpd)
milliequivalents per liter (meq/l)
nannometric turbidity unit (NTU)